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A STUDY OF THE COMMUNICATION AND DIRECTION OF FLOW BETWEEN CEREBROSPINAL FLUID AND OPTIC DISCS IN THE RAT

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Recently Griffith, Jeffers, and Lindauer[1] reported a series of experiments in which the passage of thorotrast from the cerebrospinal space to the cervical lymph nodes of rats was demonstrated. A technique based on that of Mortensen and Sullivan[2] was employed. The thorotrast (0.02 c.c.) was introduced into the cisterna magna by cisternal puncture and in 45 minutes it was demonstrated by X ray in the cervical lymph nodes. Following the method of Dixon and Heller,[3] the above workers were able to produce vascular hypertension in rats upon injecting colloidal kaolin into the cisterna magna. Such hypertensive rats did not show thorotrast in the cervical lymph nodes after it had been placed in the cisterna magna. Evidence was presented that, as Heller[3] had demonstrated in dogs, the arterial hypertension was associated with increased cerebrospinal pressure, and it was further postulated that a lymphatic block had been caused by the kaolin. At the time of this first report no figures were available for the cerebrospinal-fluid pressure in rats. This has since been investigated by the use of a bubble manometer without loss of fluid. The normal pressure is 60-100 mm. of water, while in the animals following the intracisternal injection of kaolin it was 200-300 mm. of water.

The present studies were stimulated by the failure to demonstrate, even with repeated examinations, any visible papilledema or retinal venous engorgement in albino rats that had become hypertensive (blood pressure of 180-300 mm. Hg) following the intracisternal injection of kaolin. The optic disc of the albino rat is visualized with difficulty because of the absence of pigment in the retina, the small size of the disc, and the frequent corneal haze; but repeated observations convinced us that our negative findings are valid. These findings led us to study the communication between the cerebrospinal space and the optic discs.

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FIG. 3 (GRIFFITH, JEFFERS, FEWELL, AND FRY). PHOTOMICROGRAPH OF SOMEWHAT DIAGONALLY CUT SECTION OF OPTIC NERVE, SHEATH, AND ADJACENT CONNECTIVE TISSUE, SHOWING THOROTRAST IN THE SUBARACHNOID SPACE OF THE NERVE. THE SECTION IS NEAR THE ANTERIOR EXTREMITY OF THE SHEATH.

FIG. 4 (GRIFFITH, JEFFERS, FEWELL, AND FRY). PHOTOMICROGRAPH UNDER HIGHER POWER OF CONNECTIVE TISSUE ADJACENT TO THE OPTIC DISC BUT EXTERNAL TO THE DURAL SHEATH OF THE NERVE, SHOWING THOROTRAST WITHIN MONONUCLEAR CELLS.

METHOD

Adult albino rats were used. All operations were performed under ether anesthesia. By cisternal tap, .04-.05 c.c. of cerebrospinal fluid was withdrawn, and an equivalent amount of thorotrast injected. The animals were then permitted to live for 24 hours, killed, decapitated, and the skinned head placed in formalin for 24 hours. At the end of this time the lower jaw was removed and the bony skull further cleaned of muscles. It was then placed in three-percent hydrochloric acid for two days, the acid being changed twice daily. At the end of this time decalcification was usually complete. X-ray photographs were then taken, both from the superior aspect and laterally.

This technique was employed with 15 normal rats and with 16 rats in which kaolin had been injected intracisternally. In each of these latter animals at least two hypertensive-blood-pressure readings had been obtained. In addition 4 normal rats that had received no thorotrast were killed, decapitated, and their skulls treated as described above.

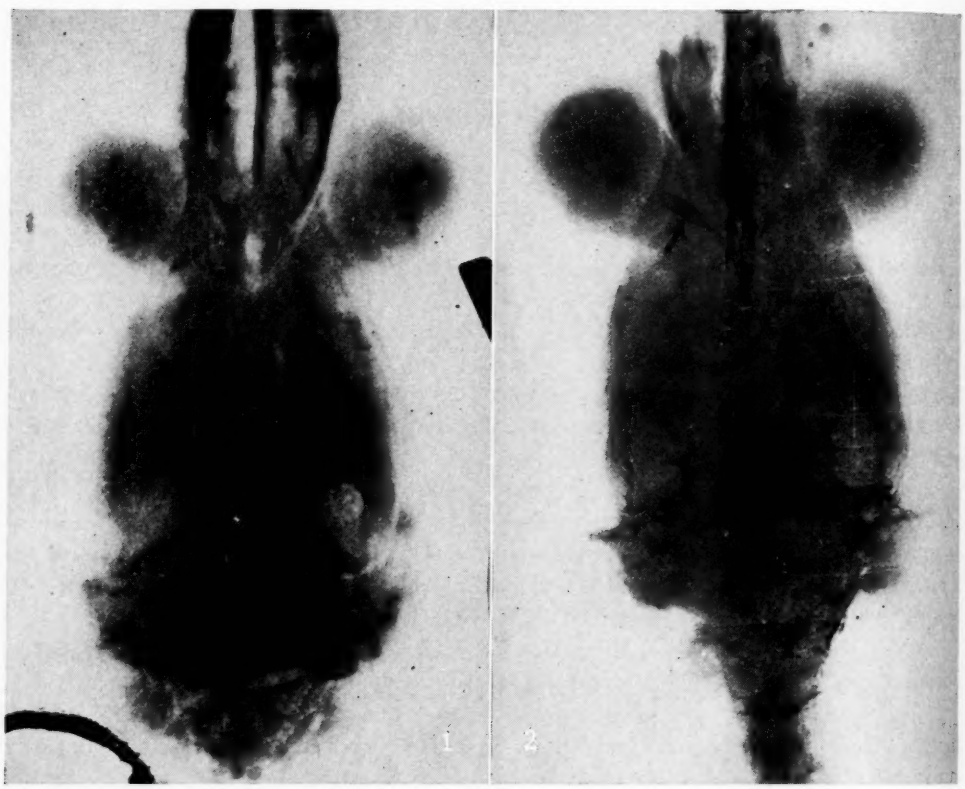

Fig. 1 (Griffith, Jeffers, Fewell, and Fry). X-ray photograph of decalcified skull of normal rat.
Fig. 2 (Griffith, Jeffers, Fewell, and Fry). X-ray photograph of decalcified skull of normal rat killed 24 hours after the intracisternal injection of 0.05 c.c. of thorotrast. Opacities mark the position of both optic discs and the optic nerves are outlined. An arrow indicates the opacity on the left optic-nerve sheath. Fine lines of thorotrast appear about the cerebellum.

RESULTS

In the X-ray film of a normal rat that has never received thorotrast (fig. 1) no opacities are seen.

A normal rat that has received thorotrast (fig. 2), shows a different picture. Fine black lines show around the cerebellum and in places extend over the anterior portion of the brain. The optic chiasm may show just anterior to the pituitary fossa, and from it the optic nerves may be seen passing as fine lines to a denser, distinctly visible shadow at the anterior extremity of the optic sheath just posterior to the optic disc. At no time was any thorotrast seen beyond the disc. Ten of the 15 normal animals showed extremely distinct disc shadows while three others showed some opacity in the area of one disc, but not a clear picture. The two remaining animals showed no thorotrast in either eye, a result that we interpret as due to inadequate injection. The last seven rats injected showed uniformly clear pictures about both optic discs. It is worth noting that the two animals showing no thorotrast in either eye, and the three showing only some opacity in the area of one disc, were among the first eight animals studied. The better visualization in the last seven consecutive cases we ascribe to improvement in the technique of cisternal injection. Four more normal animals were similarly injected

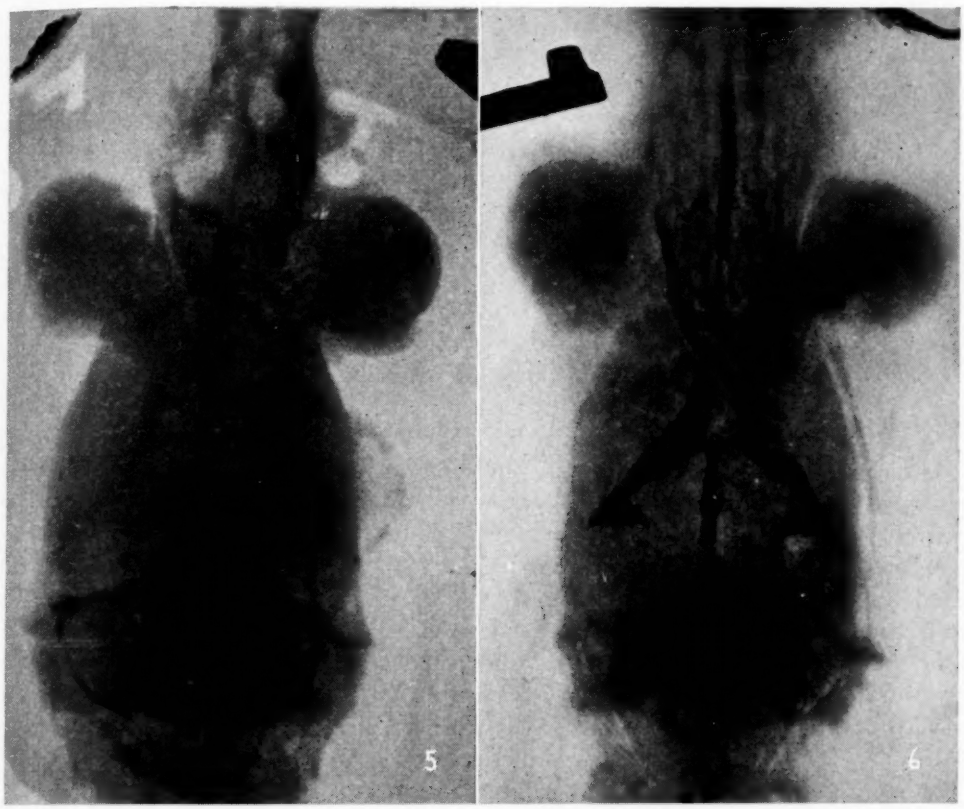

Fig. 5 (Griffith, Jeffers, Fewell, and Fry). X-ray photograph of decalcified skull of rat made hypertensive by the intracisternal injection of kaolin, injected intracisternally with .05 c.c. thorotrast and killed 24 hours later. The thorotrast appears about the cerebellum, but the optic-disc regions and nerves are not seen.

Fig. 6 (Griffith, Jeffers, Fewell, and Fry). X-ray photograph of animal similar to one shown in figure 4 in which the ventricles are outlined by thorotrast but no optic nerves nor discs are seen.

and killed at intervals of from five minutes to four hours. All showed typical disc opacity, but they are not included in the normal series because of the difference in time relations. The animals killed soon after the injection showed the best visualization of optic nerves, the best of all in this respect being an animal killed five minutes after injection. After 24 hours, as a rule, only the disc regions are clearly visible.

Histologic sections were prepared from the eyes of four animals (figs. 3 and 4). In such animals, the thorotrast was visible in two positions. It was seen first in large quantity within the subarachnoid space of the optic nerve near the anterior extremity of the sheath, and in this position was located chiefly within mononuclear cells (fig. 3). In the second position it was seen in mononuclear cells in the connective tissue adjacent to the disc but external to the dural sheath of the optic nerve (fig. 4). No thorotrast was seen in the intraocular portion of the disc nor in the retina.

Figure 5 represents the X-ray photograph of one of the 16 rats injected with thorotrast after it had become hypertensive following the intracisternal injection of kaolin. The fine lines about the cerebellum are present, the criterion that we require to prove that the preceding intracisternal injection of thorotrast was successful. In one of these 16 rats, one nerve and disc region was shown very faintly, but in the remaining 15 neither was visible.

In 8 of these 16 animals with hypertension following kaolin injection in which the optic disc regions were not visualized, we obtained clear ventriculograms (fig. 6). We have never seen this in a normal animal, not even in one killed five minutes after the injection of thorotrast. The explanation we favor is that the thorotrast is removed very slowly from the cerebrospinal space in the animal with block due to kaolin, while in the normal animals the escape is too rapid to permit ventricular visualization.

Histologic examination was made of six animals injected with thorotrast, following the production of a kaolin hypertension. Sections were obtained through the disc in all instances. In three of these no thorotrast was found. In the other three thorotrast was present within the sheath of the optic nerve, and was localized in cells of the arachnoid. In no instance did the density of the deposit of thorotrast approach that seen in the normal animals given thorotrast. In no instance of this group was thorotrast seen in cells adjacent to, but outside, the dural sheath of the nerve.

DISCUSSION OF RESULTS

The view usually accepted with respect to the lymphatic drainage from the interior of the eye and retina, is that the direction is from the eye, along the perivascular spaces of the central vessels, and then toward the subarachnoid space. The experiments supporting this view were carried out by injecting particulate matter into the vitreous and sectioning the eye after stated intervals. Such experiments have been conducted by Gifford and Wegefarth (quoted by Fry,[4] and by Berens et al[5]), Berens, Smith, and Cornwell,[5] and by Berliner.[7]

The contrary view is suggested by the work of Schmidt-Rimpler (quoted by Wolff and Davies[6]) and by Wolff and Davies, in which suspensions of nondiffusible dyes were injected into the cerebrospinal space under pressure and were recovered in the nerve head. Such studies have been criticized on the ground that the high injection pressure might reverse the normal direction of lymph flow.

In our studies the small volume of the injection (.04 to .05 c.c.) and the preliminary removal of an equivalent amount of cerebrospinal fluid, seem to render this

objection invalid. Our results suggest that the direction of flow at least in the perineural space is from the cerebrospinal space toward the optic discs and not vice versa. No investigator has reported finding any colloidal dye in the retina beyond the nerve head after injection into the cerebrospinal space. Our observations are in agreement with this. In our experiments, even if the stream of thorotrast flowed peripherally beyond the nerve head into the retina, the concentration attained may well have been too low for demonstration by the X ray. However, even in eyes that had been sectioned, no thorotrast was found within the globe.

It may be asked how it is possible for a current of fluid to be present up to a certain point, without any evidence of extension beyond this point and yet no considerable fluid collect at the site of obstruction. Our studies, however, apply only to a colloidal material, thorotrast, which appears to be blocked at a point behind the optic disc. We think of the fluid elements as passing on, perhaps into the lymphatic drainage system of the eye. A contrary suggestion might be that there may be a return or centripetal flow along the vessels of the nerve. One appealing aspect of this suggestion is that it reconciles both schools of thought. The perineural flow is centrifugal with respect to the brain, while the perivascular flow is centripetal. Choked disc might be thought to occur in the presence of a blocked centripetal flow provided the centrifugal flow is normal or increased. However, our experimental studies have no bearing on either of these hypotheses.

We believe that this study has shown that the normal direction of fluid flow in the perineural spaces of the optic nerve is from the brain toward the eye and not vice versa. To this extent we support the work of Wolff and Davies,[6] and of Schmidt-Rimpler, Schieck, and Manz quoted by them. It would appear that this route must be patent for choked disc to appear. However, we have no evidence that there may not be in addition interference with the venous and lymphatic absorption from the disc region. It may be noted that the pressure of fluid in a distended perineural space can readily be transmitted to vessels and their attendant lymphatics traversing the perineural space or coursing in the optic nerve. Contrariwise if the perineural space is blocked as after an injection of kaolin, the vessels and lymphatics just described will not be pressed upon.

SUMMARY

1. The passage of thorotrast from the cerebrospinal space to the optic disc regions has been demonstrated by the X ray and by histologic examination.

2. In 16 rats rendered hypertensive by previous intracisternal injection of kaolin, thorotrast injected intracisternally failed to appear under X-ray examination and was distinctly less evident histologically in the optic-nerve sheaths or disc regions.

3. The evidence supports the view that the normal direction of fluid flow in the perineural spaces of the optic nerves is from the cerebrospinal space toward the optic discs.

4. The bearing of this on the mechanism of papilledema is discussed.

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LECTURES ON GLAUCOMA

I. Certain aspects of glaucoma

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Chronic primary glaucoma is common in our hospital practice in South India and very unsatisfactory and discouraging to deal with.

Although our ideas on the subject have undergone a great change in the last 20 years, so that now it seems strange to read the opinions of those with great experience of the subject as set down at that period, we have become gradually accustomed to thinking in the different terms of today. Thanks to prominent research workers in Europe and America, our knowledge of the possible mechanisms productive of hypertension other than recognizable local pathological defects has been vastly augmented.

In such a complicated problem it is sometimes helpful to try from a clinician's point of view to form an appreciation of the position as it affects our own particular experience. Such an endeavor must necessarily be vague, for we still lack many data in the problem, and also somewhat unsatisfactory, since at the outset we know we shall not thereby get much nearer a real solution. It seems reasonable to assume that there are various kinds of primary glaucoma in which the predominant factors operate on or in the posterior segment of the eyeball. In some cases an increase in volume of the intraocular vascular bed may offer a sound reason for hypertension associated with vitreous-body displacement. A disturbance of equilibrium between the uveal capillary blood and the intraocular-tissue fluid may seem a satisfactory hypothesis in others.

The action of abnormal intraocular constituents on the physical condition of the vitreous gel, resulting in an increased volume of the vitreous body, so that the safety-valve mechanism of the filtration angle which at first copes with the displacement of aqueous is impaired by the encroachment on the anterior chamber, seems to account for clinical appearances with which we in India are all too familiar.

That there are different forms of primary glaucoma in which the predominant factors appear to operate in the anterior segment may also be assumed. For example, the congenital and juvenile glaucomas, possibly glaucoma simplex or other varieties of glaucoma, in which there are the various signs of tension in greater or lesser degree but without any definite indication that the vascular bed or vitreous is primarily involved or that the anterior segment is being encroached upon, may belong in this category. In pure cases of this type one is likely to consider that the safety-valve action of the filtration angle is not functioning.

Although we could not make a hard and fast subdivision of this sort, it was convenient to think of our cases as being of the anterior-segment type or posterior-segment type, and even before research workers had helped to clear the fog, we were accustomed to think and speak of the bulk of our cases in Madras as of the posterior-segment type.

We shall see later that there is at least one group of cases in which, with an apparently functioning angle and little encroachment of the anterior segment, that is to say, little change in the depth of the chamber, we assume that the glaucoma is of posterior-segment origin. This type

offers numbers of problems for the research worker, but the ordinary clinical observer tries to simplify matters by thinking of two main modes of increased primary glaucoma of the type associated with anxieties, psychoneuroses, angioneuroses, sympathetic derangements, local congestion; in fact, the vascular-bed.

If we try to trace the process back, we are likely to get confused eventually in trying to visualize the level at which the action is taking place. For instance, on the one hand we work back to the blood stream itself, the nature of its various constituents in abnormal states, their action on the various endothelia and selective epithelia of the eye, their effect on the intraocular pressure through alterations in normal chemical, dynamical, and electrical phenomena which ordinarily maintain tissue-fluid balance, or their interference with oxidation phenomena which ordinarily guarantee the normal physical properties of the vitreous gel and the nutrition of the cellular structures. On the other hand, we are led to ponder on the actual state of the vessels of the vascular bed as influenced by psychic, reflex, chemical, or other factors possibly affecting autonomic control, or their anatomic structure and function.

Such considerations do not give us practical satisfaction at present, but the clinical ophthalmologist is apt to feel that etiologically the primary-glaucoma problem is in some cases linked up with the obscure, slowly acting intoxications and deficiencies, perverted metabolic states, or the widely distributed derangements and degenerations of the capillary blood-vascular system.

Traquair of Edinburgh recently stated that the chief features present in glaucoma (he was alluding to primary glaucoma) are, first, that it is met with in elderly people, and second, that they are of an anxious nervous temperament. He goes on to say that it is a disease common to all classes of society and therefore independent of nutritive or hygienic conditions.

This is the impression of glaucoma as it exists for him, and no doubt the same would be true for others in different parts of the world.

In South India, my impression is that primary glaucoma of the type associated with anxieties, psychoneuroses, angioneuroses, sympathetic derangements, local congestion, in fact the vascular-bed type, is not so common in Indians, although we see it in Europeans; whereas the vitreous-body type is more common in Indians.

In Madras, the primary congestive glaucomas are relatively uncommon, but the slow insidious increase in volume of the vitreous body with encroachment on the anterior chamber, uveal tissue, and optic disc is ever present.

In South India, glaucoma is no doubt more common in mature age, is common to all classes of society, and is apparently independent of a nutritional and hygienic association; but we are not inclined to associate it with patients of anxious nervous temperament.

That glaucoma is independent of nutritional associations may, however, be only apparent. This depends on our conception of how defective nutrition acts.

Up to the present, very little experimental work has been done on the subject of nutritional defects of minor degree acting over prolonged time periods.

In order to get effects in a reasonable time with animals, nutritional experiments have largely been of an intensive character, but hardly designed to show the result of prolonged insidious action produced by defective or toxemic intake or prolonged endogenous interference with body-oxidation mechanisms. Nor are our biochemists yet in a position to isolate

the lesser chemical deficiencies or excesses of the blood stream. The fact that many of our primary glaucomas are determined at a relatively advanced-age period makes us think of the many other pathological manifestations of which we can only say that they are probably the result of insidious and unrecognizable noxious agents acting over a long time.

We know that there are distinguished workers who think that the vascular bed is all important in the production of primary glaucoma, but it would be too limiting to consider that it is merely because of an increased volume of this bed, or because channels of vascular ingress or egress were interfered with, that hypertension ensues. The integrity of the capillary endothelium of the aqueous-forming mechanism is perhaps equally important. To digress for a moment in connection with vascular-bed types, I feel that allergic states have yet to be thoroughly explored in this connection.

However interesting the speculations and proved facts in connection with the intraocular chemical, physical, and electrical conditions may be, and however valuable in helping us to frame rational hypotheses with regard to intraocular hypertension, we are still in almost complete ignorance of the essential origins of such local changes. It is hardly likely that we, as clinicians, can dissociate them from generalized phenomena of a similar nature throughout the body due to the same original causes. In other words, it is difficult to think of the chronic primary glaucomas as anything more than local expressions, in a peculiar anatomical field, of generalized disorders of unknown origin.

If this be so, it may be possible for those who have the opportunity of dealing with primary glaucoma in bulk to throw some light on its etiology by observing associated signs and symptoms of defective function in other parts of the body which are more accessible to ordinary methods of investigation than is the eye. To confine the inquiry into the etiology of primary glaucoma to the level of the eye is equivalent to limiting the investigation of nephrosis to the level of the kidney.

The clinical observer in India who sees large numbers of primary-glaucoma cases frequently asks himself to what generalized disorders or syndromes does this glaucoma complex belong? What are the influences at work? Are they as insidious in their action and as elusive in their isolation as some of the noxious agents which produce extensive changes in the peripheral vascular tree, or the conditions grouped as premature senility?

It is quite likely that this is so in some of the chronic primary glaucomas, and that our etiological search may merely refer us further back to the vague and unsatisfactory region in which we visualize a summation of injuries to the delicate tissues of the body which depend on a healthy capillary wall and a normal oxidation mechanism.

Fortunately there is at least one condition which gives us a definite lead in attempting to solve the problem of etiology; namely, epidemic dropsy.

Here we have an affection associated with the ingestion of a certain type of rice, manifesting itself in definite outbreaks by a toxemic (?) action on the peripheral vessels, productive of dropsy (amongst other pathological changes). One of the features of this disease is primary glaucoma of a relatively rapid noncongestive onset. It stands apart as an isolated example of a clinical combination, asking for further investigation; it places primary glaucoma in its proper environment, a symptom-complex of a disease of known etiology.

Calcutta workers have made a special study of epidemic dropsy. They have described it clinically, suggested its toxemic nature, investigated certain associated his-

topathological changes, and noted the fact that glaucoma is one of its clinical manifestations.

My colleague, Col. Kirwan, has observed during an outbreak that glaucoma may be the first isolated manifestation of this toxemia. This is surely a significant observation. The word toxemic is used broadly, since the toxemia may be an abnormal chemical state resulting from a deficiency of intake. In the glaucoma of epidemic dropsy we have a fact of unique importance as yet insufficiently recognized.

In years gone by, ophthalmologists had nothing in the way of a disease entity or syndrome with which to couple the primary glaucomas. Now, however, we realize that whatever epidemic dropsy may be, a primary noncongestive glaucoma is almost an essential part of it, and it is highly probable that whatever be the pathological changes in the general connective tissues, capillaries, and blood, these changes are common to the specialized intraocular tissues; likewise, the abnormal tissue-fluid interchange resulting in dropsy has its intraocular analogue.

I mentioned above that in thinking of primary glaucoma as of two types (for our own convenience), according to whether the volume of the posterior segment showed an inclination to avail itself of the safety-valve action of the filtration angle and encroach on the anterior chamber, or, on the other hand, with a rising tension and other evidences of glaucoma (such as cupping, field changes, and so forth) the anterior chamber remained full and the iris and contents of the posterior segment undisturbed, we were likely to get into difficulties by making the depth of the chamber a guide.

In the glaucoma of epidemic dropsy, most of the observers are agreed that even with extreme rises of tension the chamber may be normal in depth. Yet one feels convinced that the glaucoma is of posterior-segment origin and that the level of action is the ciliary capillary plexus. This somewhat puzzling picture might possibly be explained by assuming that we are dealing with a hydrops or edema of the eye with a rapid accumulation of aqueous which the angle is eventually unable to cope with but which does not affect the constitution of the vitreous body so as to cause an increase in its volume. If this is even approximately correct, we see that our old use of the term posterior-segment type can only refer to cases in which there is an increase in volume of the posterior-segment contents; that is, vitreous or vascular bed. Similarly, the old use of the term anterior-segment type should be applied only to an assumed primary interference with the safety-valve action without encroachment, and with no reason to suppose an abnormal state of vitreous, vascular bed, or tissue-fluid interchange at the ciliary-plexus level. The terms have thus outlived their usefulness, and we must think of glaucoma of posterior-segment or anterior-segment origin without limiting our horizon by the actual depth of the chamber.

To return to epidemic dropsy, unfortunately we are not yet clear as to what the nature of this epidemic dropsy is. Responsible tropical research workers consider that it is merely a form of beriberi. But as beriberi is itself an ill-defined deficiency complex and ordinarily not a pure B_1 avitaminosis, this does not get us very far. We need not discuss at length the various views on epidemic dropsy and its etiology. The subject has been dealt with by colleagues in the Indian Medical Service and others (in Calcutta). It is sufficient for us to know that outbreaks of the so-called epidemic dropsy have been well recognized, have very distinct clinical features, and are due to the ingestion of a certain type of rice.

In so far as India is concerned, and I

do not think the condition has been recognized elsewhere, it is confined to Bengal, although of course the vast bulk of the people of India are rice eaters, and beriberi in the classical form is distributed rather widely in the peninsula.

At first sight, then, it would appear to be similar to, but distinct from, the wet or dropsical forms of beriberi. No doubt those who hold it is a variety of beriberi have reasons for their faith; but this does not concern us. In Madras itself we have not much beriberi, although in the northern part of the Presidency it is endemic; and we have never recognized cases of epidemic dropsy in South India.

Acton has produced evidence indicating that epidemic dropsy is due to a toxin developed in stored rice by the action of bacteria under certain conditions of temperature and humidity. The filtrate of cultures of these organisms in rice-water media is capable of producing the symptoms of the disease in animals. The toxin is water soluble and contains bodies of the histamin group. The capillary blood system throughout the body is affected; there are definite histopathological changes with the production of edema.

During the outbreaks of epidemic dropsy, exceptionally large numbers of primary-glaucoma cases are seen in Calcutta. Ordinarily, the rate in Bengal is similar to that farther south. Glaucoma may be the first and only apparent evidence of the disease. The latter is curable by withholding rice from the diet; but unfortunately the damage done to the retina by the glaucomatous process once established is not recoverable.

Very high ranges of tension have been recorded with which sometimes, curiously enough, there are no field changes. Early anterior decompression may save the eye from damage, and when proper diet is established and the general condition of the patient returns to normal there may be no ocular sequelae. Here, then, we have an instance of a primary noncongestive glaucoma of known etiology which is at least preventable by withholding one article of diet. Perhaps we may eventually be able to show that a similar mechanism is at work in either primary glaucomas associated with ingested toxins, defective ingestion, or abnormal metabolites elaborated in the body from normal foods.

In the Madras Presidency, primary noncongestive glaucoma is very common. In the Government Ophthalmic Hospital, we see up to 400 cases per annum of primary glaucoma of posterior-segment origin. We have repeatedly asked ourselves if it is associated with any generalized affection, and from time to time in the past 15 years we have made clinical observations on a fairly large scale with a view to establishing such a relation. These so far have furnished negative results.

There are obvious difficulties connected with dietetic or drug experimentation on the human subject conducted over long periods. Controls are practically impossible. Detection of metabolic irregularities or of abnormal blood states is, perhaps, a more practical line of investigation, and no doubt our biochemists will in time give us further light on the problem of glaucoma by critical biochemical studies of the blood and tissue fluids in patients with well-marked chronic primary glaucoma. In so far as our local work is concerned, it has long been established that the primary glaucoma of South India has no association with high blood pressure.

Our hospital figures show that sex does not appear to play any part in the frequency of attack, nor does race, in so far as the different Indian groups within the Madras Presidency are concerned. We have not been able to trace any association with deficiency disease; either in the vitamin-A predominant complex, of which we see large numbers, or in the beriberi group; unless indeed we are missing clinical conditions associated with the

beriberi syndrome which have not yet been described and which act very insidiously, in contradistinction to the more acute forms of purer B_1 deficiency.

In 1928-1929 we made a series of observations which showed that primary glaucoma of a posterior-segment type was commonly associated with involutionary changes of epidermal and vascular structures. This was only to be expected, for large numbers of our patients suffer from arteriosclerosis decrescens, and nothing is more obvious amongst our hospital patients than the evidences of insults to the body of various sorts, resulting in premature tissue changes which may be loosely summed up by the term senility.

We have not yet compared the relative frequency of primary glaucoma in the rice-eating and North Indian wheat-eating groups on a large scale, but this should be done. Apparently we meet with the primary glaucomas equally in all food groups in South India, whether pure vegetarians, rice eaters, or rice and meat eaters.

The frequency of deficiency and metabolic disease in South India is suggestive, and one is inclined to consider that primary glaucoma may have a dietetic association, but the relative freedom of children is against the various avitaminoses which probably for the most part appear as chronic polydeficiencies. It remains for investigators to show how such factors operate, if they do. Apparently there is no association with our common derangement of sugar metabolism—diabetes.

With a view to determining if there was any obvious difference in the biochemistry of the blood in the primary glaucomatous patient and the ordinary nonglaucomatous hospital patient of similar age and habits of life, we undertook a series of investigations in conjunction with Dr. Mannady Nayar, the professor of biochemistry. These have been published elsewhere (Government Ophthalmic Hospital Report, 1929, appendix 2). I need only say that we obtained no information. Similarly, a series of observations were made in collaboration with the professor of chemistry, Colonel Newcomb, on the chemistry of vitreous removed from glaucomatous patients and nonglaucomatous patients, with negative results. The figures were published in the Archives of Ophthalmology for May, 1928. We have explored numerous other channels without avail and are still left in the position of relieving the intraocular tension by decompression, without having any idea as to its cause.

We are encouraged, however, by experiments in connection with epidemic dropsy to seek a correlation amongst the slowly developing defects of function originating in inadequate diet, toxemic states, and chronic alimentary affections; for if we could establish another such association it would materially help the cause. I need hardly say that we have tried various methods of treating glaucoma medicinally. Here, too, we have met with failure in every direction; but I must admit our material was hardly suitable for experimental work, inasmuch as the condition had been well established.

We have, like others, numerous records of patients who refused operation when a diagnosis of the disease was made in the very earliest stages, and subsequently maintained good vision with moderate depression of the fields for 10 or 12 years; and this with only the application of miotics when the vision felt a little dull, or some other indication announced that all was not well with the eye. When such is the case it is difficult to imagine how one could make a sufficient number of controlled observations on early cases, either dietetically or by the internal administration of drugs.

It would be seldom, indeed, that one could get a patient to keep up a regimen of diet, drug, or other treatment for 10

years; and should he do so, the only guarantee of having cured the affection would be the maintenance of tension on an even level and the preservation of the fields at the same level.

Apart from the prevention and cure in the early stages of epidemic-dropsy glaucoma by controlling the diet, it may be said of the medical treatment of glaucoma that we do not yet know of any measures which will influence the course of the disease, if we exclude regular massage and the instillation of miotics.

We know that sometimes cases of glaucoma, when diagnosed early and cared for in this way, are better off, or, shall we say, have run less risk at the end of a decade than if they had been surgically interfered with. We are also in a position to say that massage and miotics are frequently used by many, subsequent to apparently successful sclerocorneal trephining or other types of anterior decompression.

These statements must not be taken as meaning that I am not an advocate of anterior decompression for primary glaucoma; I am. I have, as a rule, very little option in hospital practice and must fall back on operative measures. But looking back on the position of the operative treatment of glaucoma in the past 25 years, I have formed the impression that there has been far too great an inclination to rush private patients into operation on the assumption that because it is the best thing in some it must be the best for all. I need hardly say that in making a decision against operation, all the facts, particularly the age, condition of the other eye, the size of the field, the economic position, and the relative bearing of a vascular influence, must be carefully weighed.

Prima facie, we might consider that decompression ought to be more effective in primary glaucoma of anterior-segment origin, such as early congenital glaucoma, glaucoma simplex, primary vascular-bed types, in association with combined treatment towards influencing intermittent vascular-bed phenomena and cases of the epidemic-dropsy group (hydrops) pending removal of the cause; and of less value in primary glaucoma of posterior-segment vitreous-body type. In the latter, decompression is quite likely to fail in the long run, although it may for a time relieve the eye and put off the evil day.

When the nature of the vitreous body is so interfered with that it continuously increases in volume and the chamber is finally obliterated, a valvular leakage from the anterior segment cannot save the situation. This is a relatively common sequence in very advanced cases, and multiple anterior decompression does no good. That there are other factors beyond those of mere tension is common knowledge. Observations of patients operated on support this. The failure of good decompression operations in warding off field changes suggests that the failure is not always due to ineffective reduction of tension.

The same factors which produce the abnormal state of vitreous persist. We are consequently left wondering whether they also interfere with the retinal function, regardless of the reduction of tension. One of the most depressing facts in connection with the operative treatment of certain cases of primary glaucoma is that the eye may be lost eventually, despite a perfectly achieved decompression. One important consideration which may be viewed from various angles is that in early primary glaucoma a well-executed anterior decompression is an easy and relatively harmless procedure. This is hardly so in advanced cases.

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(To be concluded in the next issue.)

THE AVOIDANCE OF DYNAMIC ACCOMMODATION THROUGH THE USE OF A BRIGHTNESS-CONTRAST THRESHOLD*

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Although dynamic accommodation is preventable through paralysis of muscular activity, it is obvious that this result can likewise be achieved by the avoidance of an adequate stimulus for accommodation. In ophthalmic practice, accommodation is readily controlled by mydriatics. In the present discussion, a method is proposed for accomplishing this objective, without drugs, through the use of a brightness-contrast threshold in the process of refraction. The apparatus involved has been described briefly in a previous issue of this Journal[1] and the technique is designated herein as the sensitometric method. Although the control of accommodation is assumed to be a characteristic of both techniques, it does not follow that the physiologic functions are identical in both situations. Cycloplegia inhibits both dynamic and tonic accommodation, while tonic accommodation is assumed to remain functional during the sensitometric measurements. The latter characteristic, regardless of its actual or eventful clinical significance, is recognized rather than emphasized in the present discussion.

Since it has been adequately demonstrated that the effects of external physical variables upon visual function may be measured with unusual precision by the sensitometric method,[2] it seems reasonable to assume that this technique might also be precise in measuring the effects of biological variables upon visual function. If this assumption is justifiable, the new method presents a means for greatly increasing the precision of subjective data and for augmenting the significance of subjective methods of refraction. However, it is emphasized that this discussion is presented from the viewpoint of the potentialities of a new method rather than as a description of a recommended and refined technique thoroughly established by clinical experience. Furthermore, the discussion is confined chiefly to the variable of accommodation in static refraction since it is obvious that clinical data are ambiguous if this factor is not controlled.

VISUAL THRESHOLDS

Although visual acuity has been used almost exclusively in ophthalmology as a criterion of visual efficiency, this practice has been more optional than mandatory. Obviously , the brightness, contrast, and duration of the stimulus are also, along with size, parameters of the visual threshold and possesses fundamental significance, since all are interdependent variables.[3] If an object is visible, it is by reason of the fact that the magnitude of each of these four fundamental variables of the visual threshold is either equal to or greater than a definite liminal value. The magnitudes of these liminal values depend not only upon the observer and external physical factors, but also upon the character of visual recognition demanded. The latter may involve, in order of increasing visual difficulty, the mere recognition of the presence or absence of an object, the recognition of form and the resolution of space-intervals in the discrimination of form. Thus visual-acuity measurements, for example, involve (1) variable of size and the constants of brightness, contrast, and duration of the

*From the Lighting Research Laboratory, General Electric Company.

stimulus and (2) the resolution of space-intervals.

The relationship between the factors of size and contrast of the threshold stimulus, as determined by subjects possessing average normal vision, is shown in figure 1 for three different brightness-levels.[3] It will be obvious from this figure that the term "visual acuity" is merely descriptive of *one* of an infinite number of visual thresholds by which visual efficiency might be appraised. Furthermore, it is evident that such factors as the density of the retinal mosaic and the magnitude of aberrations progressively become less important, and factors such as retinal sensibility and pupil size become more important as the contrast between the object of regard and its background is decreased.[4] Thus, for one extreme, the areal characteristics of the threshold stimulus are of major importance; for the other extreme, the photometric characteristics are all-important. This transition is perhaps more clearly revealed by plotting the relationship between size and contrast on arithmetic coördinates as in figure 2.

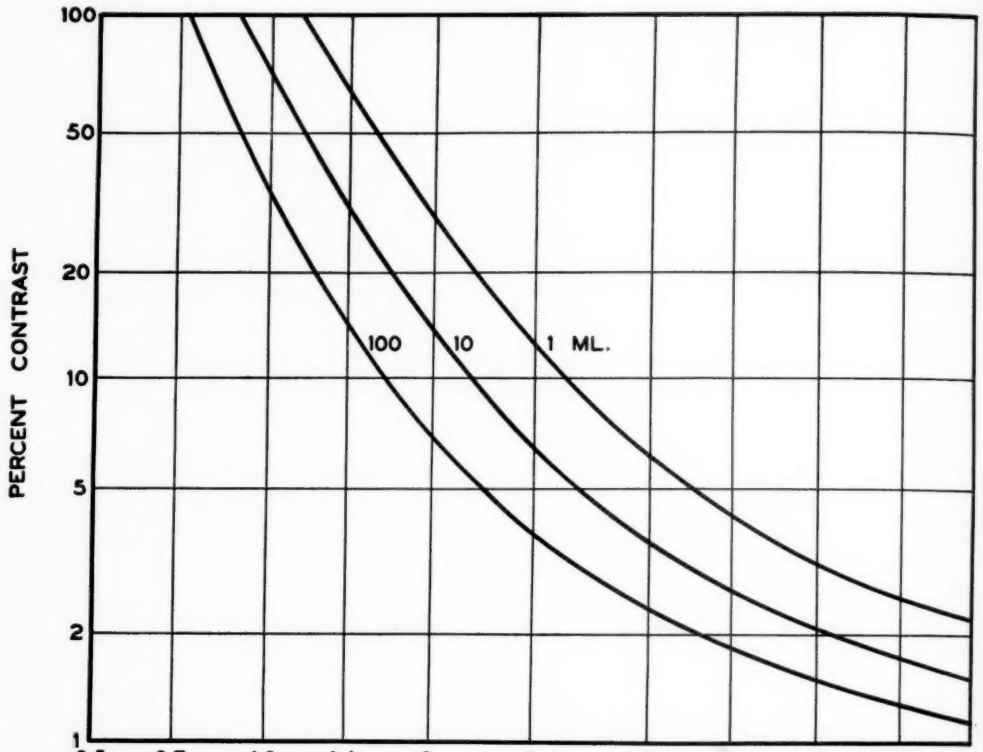

Fig. 1 (Luckiesh and Moss). The relationship between size and contrast in the liminal stimulus for the resolution of space-interval. These data were obtained from tachistoscopic exposures of test objects (fig. 5) of various sizes by determining the liminal values of contrast for each test object presented. These measurements, totalling approximately 100,000 observations, were made at a distance of 6 meters. The exposure-time was 0.17 second. This datum is considered as representative of the duration of the average fixational pause.

In clinical practice the contrast between

the test object and its background is generally that obtained with a "black" object upon a "white" background which is illuminated to a constant but often unknown brightness. Thus the various characters of the Snellen Chart, for example, could be represented, approximately and from an objective basis, by points along the abscissa of 100-percent contrast in figure 1. Obviously, test objects of lower contrasts could be specified with equal justification from the viewpoint of physiologic optics. In the world of seeing, high contrasts are involved in reading and similar tasks, and hence an appraisal of visual efficiency with test objects of maximal contrast is correspondingly appropriate. On the other hand, many visual objects or tasks involve extremely low contrasts. These are found throughout the work-world. In a fairly extreme case, such as objects to be seen on the highway at night, an appraisal of visual efficiency by the criterion of minimum perceptable brightness-difference is a far more appropriate one.

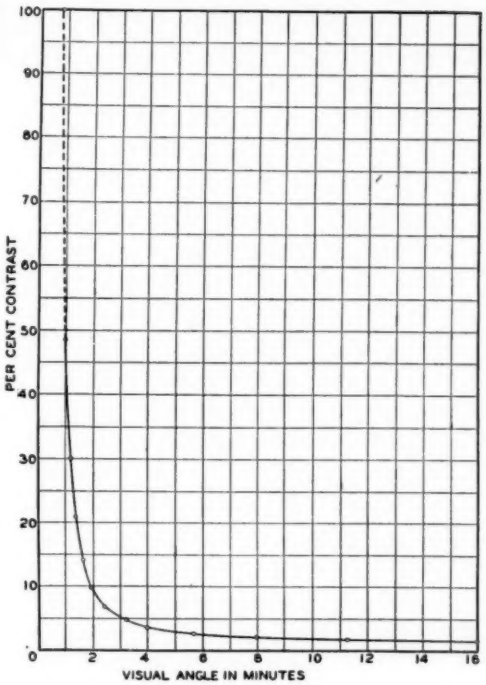

Fig. 2 (Luckiesh and Moss). The relation between size and contrast for a brightness-level of 20 millilamberts and an exposure-time of 0.17 second.

The relative visual efficiencies of a group of subjects, when appraised with test objects of various contrasts illuminated to the same brightness, is indicated by the data of table 1.[3] In this case, the criterion of visual efficiency involves the resolution of space-intervals. It will be noted, for example, that Subjects 2 and 3 possessed approximately the same "visual acuity" (reciprocal of the values in the table) when the appraisal was made with black test objects upon a white background (contrast = 100). However, the "visual acuity" of Subject 2 was more than twice as great as that of Subject 3 for very light-gray test objects upon a white background (contrast = 2). For the group of nine subjects the mean varia-

TABLE 1

THE THRESHOLD SIZES OF OBJECTS IN MINUTES VISUAL ANGLE FOR CONTRASTS OF 100, 10, AND 2 PERCENT, RESPECTIVELY. THE PROBABLE ERRORS OF THESE THRESHOLD VALUES ARE OF THE ORDER OF 1 PERCENT. BRIGHTNESS-LEVEL, 20 MILLILAMBERTS.

Percent Contrast	Subjects									Percent Arith Mean Variation
	1	2	3	4	5	6	7	8	9	
100	0.83	0.79	0.77	0.74	0.85	0.78	0.70	0.91	0.75	6.0
10	1.83	1.59	2.11	1.80	1.98	2.83	1.67	2.24	1.68	14.4
2	8.50	5.44	14.00	7.15	13.80	14.70	6.90	9.40	6.20	32.1

tion from the mean visual efficiency increased from 6 to 32 percent, respectively, when the contrast of the text objects was lowered from 100 to 2 percent. Hence it may be concluded from both theoretical and empirical considerations that the term "visual acuity" is rather ambiguous as a criterion of visual efficiency.

Since the data of table 1 involve extremely short exposure-times (0.17 second), it is not unreasonable to suppose that the observed differences in visual efficiency may be due to the perspicuity of the subjects more than to physiologic factors. If so, then perspicuity is influenced by the contrast characteristics of the threshold stimulus, since all measurements presented in table 1 involve the same exposure-time. However, in a previous paper[1] it was shown that quite different ratings of visual efficiency were also obtained when the various appraisals of visual efficiency involved unlimited time for observation.

In general, this phase of the discussion pertains to the characteristics of various thresholds, and is preparatory to discussing a particular characteristic of contrast thresholds; namely, the absence of a stimulus for dynamic accommodation.

The measurement of visual function

Some of the more important characteristics of threshold measurements of visual function involving the criteria of minimum size and minimum contrast, respectively, are presented in figure 3. The factors included between the first and third major junction-points of figure 3 are chiefly those related to the external physical environment and to the more or less direct psychophysiological effects produced by these physical conditions. In general, these represent the nonvolitional elements in seeing. The phases which follow these are initiated by the subject himself and are somewhat modified by the physical characteristics of the objects of

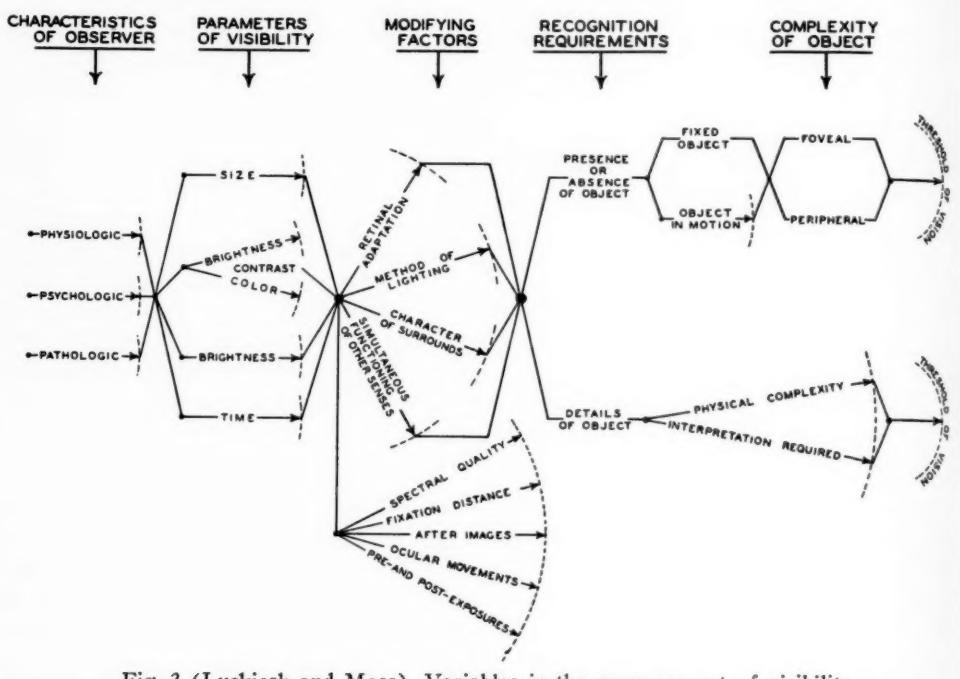

Fig. 3 (Luckiesh and Moss). Variables in the measurement of visibility.

regard. This is the realm of seeing in which factors that contribute largely to the variability of measurements[5] of visual function are introduced.

It will be obvious from a consideration of figure 3 that the influences and effects of many of these variables of the visual threshold are markedly different when the appraisal of visual function involves different criteria. For the purposes of this discussion, the most interesting and unique difference between these two criteria is due to the fact that the usual threshold visual-acuity stimulus is invariably a stimulus for accommodation. Furthermore, this stimulus for accommodation is present even though the eye cannot resolve the details of the object of regard. This is not necessarily true when a contrast threshold which does not involve the recognition of form or the resolution of space-intervals is employed in the appraisal of visual function.

Stimuli for accommodation

As the threshold of resolution is approached, by the usual visual-acuity techniques, it is obvious that the critical details of the test object gradually become unrecognizable although the object *as a whole* may be perceived readily. For example, it might be impossible for a subject to distinguish between the letter O and the letter C, of a given line of the Snellen Chart, but in both cases the *presence* of these characters might be recognized with ease. Thus it may be assumed that sufficient stimulation is received, under these conditions, to induce accommodation. This fact has long been recognized as a source of error in subjective refraction and one which is particularly significant in the refraction of young hyperopic subjects.

If a brightness-difference threshold is approached from a subliminal condition, it will be obvious that there can be no stimulus for accommodation until the threshold of visibility is reached. This conclusion is based upon the assumption that the test object is located in the center of an extended field of uniform brightness and is, therefore, the only object available for foveal or macular fixation. However, it is tentatively assumed that this technique for the appraisal of visual function does not inhibit tonic accommodation and that this characteristic of the sensitometric method is an important one in ocular diagnosis.

It is conceivable that accommodative action during static refraction might be prevented if the details of a test object such as the Ives crossed-grating apparatus are gradually enlarged until resolution of the parallel lines is accomplished. In this case, the visual field would appear as a uniform gray area until the individual lines were resolved, and until this condition was attained it is assumed that the stimulus for accommodation would be nil. This conclusion is based upon the assumption that the "crossed-grating" pattern extends over the entire visual field. Obviously, the boundaries of a test object of restricted size would constitute objects for fixation and accommodation. Thus it may be concluded that the means for preventing accommodation that have been described depend upon the technique of presenting the test object rather than upon some inherent and unique characteristice of a particular fundamental variable of the visual threshold. However, the use of a brightness-difference threshold seems far superior to the acuity method from the standpoint of practicability.

Experimental results

The data of figure 4 relating visual function and dioptric power of ophthalmic lenses are more or less typical of those obtained through the use of visual acuity and brightness-difference, respec-

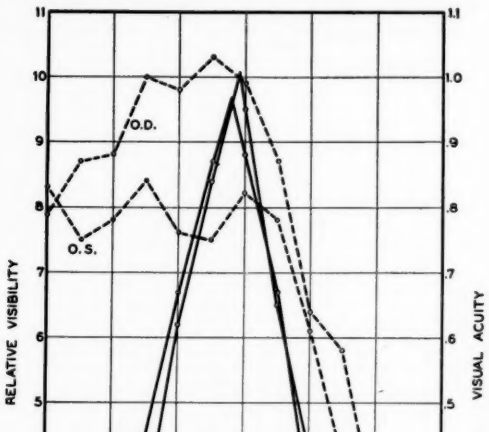

Fig. 4 (Luckiesh and Moss). The broken-line curves give the values of visual acuity obtained when the observations were made while the subject viewed the test object (fig. 5) through various powers of spherical lenses. The subject was permitted unlimited time in determining the size of the test object just visib'e. Each of the plotted points represents the average of five separate observations.

The solid-line curves give the sensitometric values obtained when the test object (fig. 6) was viewed through various powers of spherical lenses. These data involve a brightness-contrast threshold as a criterion for measuring visibility. It will be noted, from the symmetry of these curves, that there is no indication of dynamic accommodation. The time for making the observations was not restricted.

Fig. 6 (Luckiesh and Moss). The form of the test object used in the sensitometric technique. The configuration of this test object is such that it is of uniform visibility, under threshold conditions, with respect to its longitudinal dimension. This characteristic minimizes the indefiniteness common to all threshold stimuli. The actual test objects used consisted of a black bar 60 minutes in length and 1.5 and 3.75 minutes in width at the center and extremities, respectively.

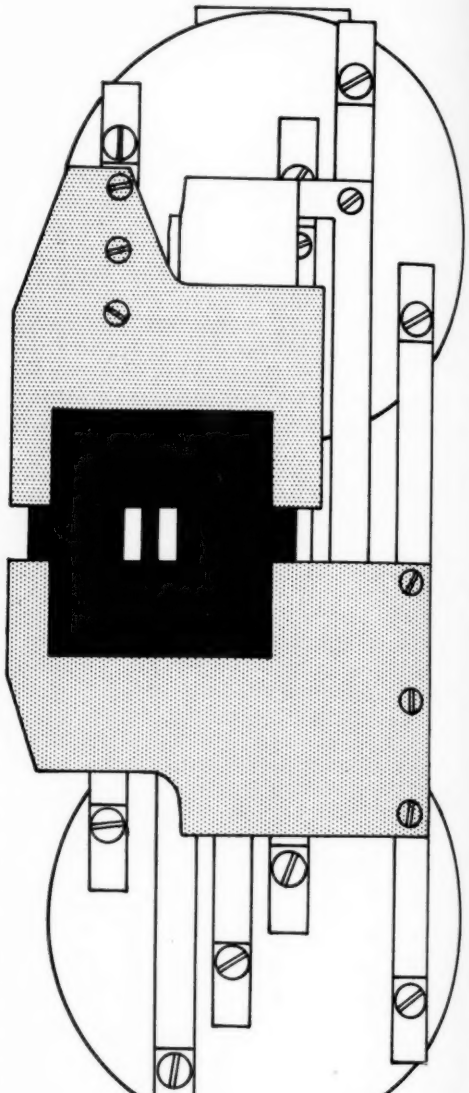

Fig. 5 (Luckiesh and Moss). The Cobb visual-acuity apparatus. The space between the two bars is equal to their width and these dimensions may be gradually altered, without change in the proportions shown, by the turning of a suitable handwheel by the subject.

tively, as criteria for the appraisal of visual efficiency. The former measurements were made with the Cobb test object, shown in figure 5, which is uniformly alterable in size, but not in form; and the latter by the sensitometric method involving a single biconcave-bar test object. This test object is illustrated in figure 6. Since the subjects used in this phase of the investigation were 20 to 30 years of age, their amplitudes of accommodation were more than sufficient to compensate for overcorrection with concave lenses within the range of dioptric powers involved if stimuli for accommodation were received. It will be noted from figure 4 (broken lines) that the exercise of accommodative effort is plainly revealed in the series of measurements involving visual acuity as a criterion. Actually, this is a method of measuring the positive relative amplitude of accommodation for the particular test object and fixation distance involved. However, no such tendency is indicated (solid lines) when a brightness-difference threshold was used in the appraisal of visual efficiency. This latter criterion involved *only the recognition of the presence of an object* in the visual field without regard to form or details. These data were obtained by viewing (natural pupil) through a gradient filter a black test object at the center of a uniformly illuminated extended white field, and by increasing the apparent contrast and brightness until the test object became visible. This procedure has been discussed in more detail elsewhere.[1] Similar results were obtained by viewing a uniformly illuminated white test object with a black surrounding field. In the latter case, with the room darkened, the white test object obviously constituted the only available fixation target. In addition, the subject began each measurement while looking through the gradient filter which further removed any possibility of seeing details of the visual field, with the exception of the white test object.

These data are consistent with the statement of Sheard[6] that ". . . light and color, per se, as obtained by the use of filtered radiation for fixation objects, supply but little, if any, stimulus for accommodative action."

The approximate symmetry of the curves relating dioptric power and visual function, about the axis of maximum visual efficiency, indicates that dynamic accommodation was not exercised when the measurements involved minimum perceptible brightness-difference as a criterion of the visual threshold. Since these monocular data were obtained with a fixation-distance of six meters, it seems reasonable to conclude that accommodative effort, if it were exercised, would prevent the attainment of even approximate symmetry due to the differential effects of concave and convex lenses. Furthermore, it will be noted from figure 4 that the dioptric power corresponding to maximum visual efficiency (as obtained by extrapolation) is quite sharply defined when determined by the sensitometric method. It does not follow, *a priori*, that the ophthalmic lens producing maximum visibility should necessarily be prescribed. However, a preliminary investigation indicated that the sensitometric method (based upon a brightness-difference threshold) rather consistently indicates more minus or less plus power than does retinoscopy. A theoretical explanation of this observed differential and its quantitative correlation with clinical observations will be presented in a later separate discussion.

It is not implied that the results obtained by the subjective sensitometric method are nearer the "true values" than

are retinoscopic findings, since, as Sheard states, full corrections in hyperopia, for example, are rarely accepted without some blur. Nature has to be taught new habits, and readjustments to innervations have to be accomplished. However, it seems reasonable to assume that the sensitometric data, in conjunction with retinoscopic findings, will be of considerable value in diagnosis and particularly in those cases where the results obtained by these two methods are not in agreement. Thus the advantages of the sensitometric method are realized, to the fullest extent, in those cases which are difficult to diagnose.

A statistical analysis of the sensitometric data from ten subjects for the purpose of appraising the symmetry of the relationship between dioptric power and visibility is presented in table 2.

The duration of the stimulus has not been considered in this discussion of visual thresholds since it is governed *ad libitum* by the subject and the same temporal conditions prevail in the various techniques described. To this extent they are not representative of the conditions which obtain in most actual cases; for instance in reading and automobile driving.

The data of table 2 indicate that the average decrements in visibility resulting from over- and undercorrections of one-half diopter, respectively, are about equal, thus denoting a symmetrical relationship between the two variables. The definiteness of the maxima of visibility and the symmetry of the relationships, for the "typical" subject, will be clearly shown by plotting these average values. These data also indicate that the average percentage of maximal visibility obtained with over- or undercorrections of one-half diopter is 77 with a probable error of 0.5. However, this value is apparently a function of the brightness and contrast characteristics of the entoptic stimulus. The latter, therefore, govern the "sensitivity" of the method to changes in dioptric power.

The sensitometric data presented in figure 4 involve merely the recognition of the presence of the biconcave-bar test object as a criterion of threshold vision. When a Snellen Chart was substituted for this test object and the subject required

TABLE 2

THESE VALUES ARE THE PERCENTAGES OF MAXIMAL VISIB'LITY OBTAINED FOR CORRECTIONS OF ONE-HALF DIOPTER, PLUS AND MINUS, ADDED TO THE DIOPTRIC POWER CORRESPONDING TO MAXIMUM VISIBILITY

Subject	Left Eye Meridian				Right Eye Meridian			
	Best Vision		Worst Vision		Best Vision		Worst Vision	
	+	−	+	−	+	−	+	−
1	68	88	75	81	60	71	78	82
2	69	71	70	70	67	78	68	66
3	80	67	86	84	75	61	77	82
4	80	77	78	84	74	77	77	81
5	65	75	69	77	74	77	83	62
6	77	78	81	76	73	77	76	76
7	87	88	72	73	85	86	86	82
8	68	81	64	68	69	85	54	77
9	83	74	71	71	88	84	83	89
10	89	82	91	80	82	79	70	85
Mean	77	78	76	76	75	78	75	78

to recognize the individual letters thereon, the resulting relationship between visual function and dioptric power was not only far from symmetrical, but also did not always indicate a definite maximum in visibility. This result is consistent with the hypothesis advanced that such a test object constitutes a stimulus for accommodation when subliminal conditions for *resolution* prevail.

Introspective considerations

The subjects consistently reported that a series of monocular sensitometric measurements taken over a period of 30 minutes or more did not induce an unusual feeling of ocular fatigue when the visual threshold was approached from the subliminal condition. These experiments involved the measurement of visual function while the subject was looking through various powers of both convex and concave lenses. When similar measurements were made by approaching the threshold from the supraliminal condition, the subjects reported definite strain and fatigue within a relatively short time.

Furthermore, the symmetry of the typical inverted "V" curves (fig. 4), was seriously distorted when the measurements were made by approaching the visual threshold from the supraliminal condition. In this case the measurement of visual function through each lens begins with a test object of relatively high visibility and, concomitantly, a strong stimulus for accommodation. As the threshold is approached by gradually reducing the contrast between the test object and its background, the innervation which may induce or maintain accommodation is progressively reduced and at the absolute threshold becomes nil. Nevertheless, measurements taken by this technique are quite likely to be influenced by accommodative effort, since a stimulus for accommodation has been present to some degree during the operation. It may be concluded from these experiences, that accommodative effort was not exercised in approaching the threshold from the subliminal condition in the attempt to compensate for the various lenses successively placed before the eye.

It should be emphasized that the purpose of refraction is not merely to study the optical properties of the uninnervated eye, for as Southall states,[7] "The important question after all is as to how the individual patient actually focuses his eye for distinct vision, and so far as clinical methods are concerned, the ultimate decision will probably have to depend upon the subjective investigation." This does not exclude the possibility that the accidental error of the subjective method may exceed the systematic error of the objective method employed. Measurements at any particular distance and at any one time obviously give no definite assurance of what the patient will do, or can do, at some other distance or at another time.

Summary

The sensitometric method possesses the following indicated characteristics: dynamic accommodation is controllable without the use of drugs and without inhibiting tonic accommodation; and the significance of subjective refraction is enhanced due to the precision and reliability of the subjective data obtainable. Obviously much additional clinical research is necessary to evaluate the clinical significance of these conclusions. The major purpose of this discussion is to suggest such researches.

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Nela Park.

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THE ETIOLOGY OF SQUINT*

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The question as to the origin of squint has been discussed for more than two centuries. Innumerable theories have been published; most of them are so poor, or even atrocious, that they are not worth mentioning. De la Hire (1743) assumed that, if the area of greatest visual acuity, due to a faulty development, were not situated at the posterior pole but at a peripheral part of the retina, such an eye must take a position in which the displaced macula would bear the image of an outlying object fixated with the other eye. This hypothesis was based on the well-known fact that in many cases of one-sided amblyopia the squinting eye has no central fixation: in convergent strabismus, for instance, it is turned inward if the patient is asked to look at an object while his normal eye is covered. J. Müller (1826) founded his doctrine of a so-called strabismus incongruus on the theory of a "false," that is, displaced macula. Persons with that anomaly were supposed to choose a squinting position in order to see single because of a displacement of one of the maculae. J. Müller's theory seemed to be substantiated by the so-called paradoxical diplopia arising after an operative correction of the deviation. We know today that this kind of diplopia has nothing to do with a congenital displacement of one macula, but originates from an anomalous sensorial relationship between the two eyes. Buffon (1743) considered the inequality of the two eyes to be the cause of strabismus. According to Buffon the patient resorts to squint in order to avoid the disturbance arising from the blurred and distorted retinal images of the weaker eye. One remembers this old theory of Buffon's in view of van der Hoeve's theory of diplopiaphobia as one of the causes of strabismus. After Dieffenbach (1840) had, for the first time, straightened the eyes by myotomy, a disproportion between the muscular functions due either to abnormal insertion or abnormal structure was believed to be the true or main cause of strabismus. The investigation of the problem was considerably advanced by Donders's discovery (1863) of the intimate relationship between accommodation and convergence, and of the role played by hyperopia in the etiology of convergent strabismus, owing to the

* From the Eye Clinic and the Department of Research in Physiological Optics, Dartmouth Medical School. Read before the Washington, D.C., Ophthalmological Society, November 2, 1936.

excessive accommodation required in hyperopia to obtain sharp retinal images. To be sure, Donders already realized that convergent strabismus develops only in a comparatively small fraction of hyperopic eyes and that the same amount of hyperopia may be found in people with and without squint. He ascertained that the chance of acquiring convergent squint increases according to the inferiority of the vision of one eye. As long as both eyes have equal vision the tendency to see single is strong enough to loosen, within certain limits, the connection between accommodation and convergence, so that the visual lines may be kept parallel, notwithstanding an accommodative effort to overcome hyperopia up to 3 or 4 diopters. Likewise, an absence of the necessity for accommodation due to myopic refraction is, according to Donders, the starting point in the etiology of divergent squint. Donders's doctrine has been substantiated by those cases in which convex glasses correcting an existing hyperopia cause the convergent strabismus to disappear. On the other hand, grave objections have been made to the over-estimation of the part played by refractive errors in the etiology of squint. The main objections are as follows: 1. The great majority of people with refractive errors do not squint. 2. Among the patients with convergent squint there are numerous cases with very slight hyperopia as well as with emmetropia, and even myopia; on the other hand there are a great many cases of divergent strabismus with emmetropic or hyperopic refraction. 3. As a rule, the angle of squint does not correspond to the excess or lack of accommodation required because of hyperopia or myopia, respectively. Usually, at least in convergent strabismus, the deviation is much greater than it should be if the excess of convergence were just proportional to that of accommodation compensating the hyperopia. As to divergent squint, although about 50 percent or more of such patients are, indeed, myopic, nevertheless a complete lack of accommodation will cause only a *relative* divergence, that is, an insufficiency of convergence in near vision, but not necessarily an absolute divergence for distance. The partisans of Donders's doctrine have not been able to refute the above objections satisfactorily. When it is considered to be the rule that the relation between accommodation and convergence can be adapted to the requirements of binocular single vision in spite of refractive errors, there is still the question to be answered: Why, in a small percentage of hyperopic patients (8-9 percent), notwithstanding fairly good and equal vision of both eyes, does the so-called relative range of accommodation not help them to have sharp as well as binocular single vision? Hyperopia does, indeed, play an important part in the etiology of convergent strabismus, but occurs as the sole cause of *permanent* squint only in persons in whom the fusion tendency is weakened or suspended by one-sided amblyopia. Only a *periodical* squint will arise in hyperopic persons who have equal vision in both eyes, if the amount of hyperopia exceeds the amplitude of the relative accommodation, and the excessive accommodative effort necessary to overcome the refractive error cannot be reconciled with a convergence innervation required by the distance of the fixated object. So long as the hyperopic person does not mind indistinct vision the eyes will be parallel in spite of the hyperopia, provided there is no other anomaly that produces the cross-eyedness. Uncorrected myopia may be responsible for an insufficient convergence innervation but will cause a divergent squint for *distance* no more than would a complete loss of the convergence movement in cases of convergence paralysis, if their position

of rest is orthophoria. Thus we may take it for granted that ametropia cannot cause a permanent squint unless there is at least one assisting etiologic factor.

According to Schweigger and Alfred Graefe, either the mechanical elastic predominance of one group of muscles or an insufficiency of the antagonistic group must be considered as the main cause of strabismus. Stilling and Landolt claimed that squint will develop only in patients with either a convergent or divergent position of the eyes due to topographic-anatomical, that is, mechanical factors, when binocular fixation is abolished. French and English authors, such as Panas, Parinaud, and Priestley Smith, in discussing the origin of squint, lay the main stress on a deficiency, or on a disturbance of the cortical nervous centers governing binocular single vision. Panas, for instance, considered convergent strabismus to be a purely functional anomaly, in which neither the peripheral nerves nor the eye muscles were affected. He referred to the disappearance of convergent squint during sleep and narcosis, moreover, to the role played by heredity, and particularly the neuropathic constitution, in the etiology of squint. C. Worth and many of the modern authors are inclined to minimize the importance of refractive errors, muscular imbalance, and other factors. In C. Worth's opinion, the decisive factor causing strabismus is a congenital deficiency of the fusion apparatus, or one acquired in earliest childhood.

Thus, it must be confessed that up to this day the etiology of squint has not been cleared up satisfactorily, no theory being applicable to all the different kinds of strabismus. However, the further investigation of our problem may be started with some unequivocal facts. The factors which play a part in the etiology of strabismus may be divided into three groups, according to their different nature. The faulty position of the eyes relative to each other may depend on mechanical conditions, such as the anatomic relation between the eyeballs and their adnexa, on the physical qualities of the latter, particularly of the fascia and the muscles, on their elasticity, length, insertion, and so forth, on the volume and the quality of the tissues behind the eyeballs, and finally on the size and form of the orbits and the bulbi. In a second group the mechanical conditions may be perfectly normal but an excessive or spastic motor innervation may produce squint of one kind or another. In a third group both mechanical and nervous factors may be combined in causing a squint. But, as a rule, all these factors will produce merely a *periodic* squint so long as the fusion apparatus is strong enough to overcome the tendency to squint. If the fusion faculty is weakened or lost a *periodic* squint may become *permanent*. Let us consider the cases belonging to the first group. Only a small fraction of them shows a *permanent* squint due to mechanical factors, such as adhesions between the eyeball and the orbital bones caused by injuries, or which may be caused by an anomalous muscular structure, either of congenital origin or acquired during life as a result either of lesions, inflammations, or tumors. In most cases of the first group the tendency to squint cannot be derived from a specific mechanical trouble, since there can be found neither a restriction nor an excess of any ocular movement. The only proof which may be ascertained that the anomalous position of rest in those cases is based on mechanical conditions is by excluding, as far as possible, those innervations which may affect the position of the eyes relative to each other; for instance, by correcting any existing hyperopia and suspending the influence of the fusion apparatus. We know from extensive investi-

gations that in at least 80 percent of normal persons of different ages and sex the position of rest is not orthophoria but some kind of heterophoria or latent squint that occasionally becomes manifest for a shorter or longer period if the fusion faculty is weakened either by fatigue, exhaustion, illness, or a narcotic. In all such cases the squint will become permanent when the fusion faculty is definitely lost. I have made an extensive study on 289 patients whom I had known when their eyes were normal and coöperated perfectly in binocular vision.[1] After the latter was lost because one eye had become highly amblyopic or blind as a result of an injury or an illness, or after a cataract had been removed, strabismus developed; in more than two thirds of the patients it was a divergent squint amounting to more than 6 degrees in 50 percent; in 10 percent divergence was combined with a vertical deviation. Convergent strabismus developed in only 10 percent of my patients after the loss of binocular vision. But by comparing the frequency of the different kinds of squint in people who had lost fusion in an earlier stage of life with those who had lost it later on, I could ascertain that in children under 15 years convergent squint developed four times as frequently as in people who lost binocular vision after they were 30 years of age, a proof of the gradual change of the position of rest and of the fact that during adolescence convergent squint will, not infrequently, disappear spontaneously. From these statements we must infer that an anomalous position of rest, that is to say, a heterophoria or latent squint based on anatomic-mechanical conditions, may temporarily become a *manifest* strabismus but never a *permanent* one, so long as there is a functioning of the fusion faculty. The same is true in cases of the second group, in which strabismus is caused either by excessive normal or by abnormal innervations; for instance, by an excessive convergence innervation arising when an excessive accommodation is required in hyperopia to get clear retinal images, or in cases of double hyperphoria, which is produced by involuntary spasms of the vertical divergence innervations. In all these cases the temporary or periodic squint will not become permanent so long as the fusion apparatus is strong enough to overcome the tendency to squint. As to the cases of typical relative hyperopia, as it was called by Donders, a permanent squint will not arise even if the fusion tendency is lost because of one-sided amblyopia or blindness. Those patients show convergent squint only temporarily; namely, when they try to get clear retinal images by an excessive accommodative effort. The presence of a *permanent* convergent squint in such cases would always suggest that there is a third etiological factor in addition to both hyperopia and the loss of fusion. Even in the majority of the cases belonging to the third group, in which both mechanical and nervous factors produce the tendency to squint, there will be a periodic squint unless a third factor, namely, the loss of fusion came to be associated with the two other factors. There are exceptions to this rule. First, it is obvious that it depends on both the kind and the degree of the anomalous position of rest whether or not it can be overcome by an adequate fusion innervation, the range of which, although varying considerably in different individuals, is limited. Second, it may depend on the kind of work which the patients are doing and on the time they must give to it whether or not a periodic squint due to both an anomalous position of rest and excessive motor innervations may be transformed into a permanent strabismus. That may occur in such a way that a contracture of a muscle, or a group of muscles, which

in the beginning, is functional, that is, contraction and relaxation, respectively, taking place according to circumstances, may become fixed by a gradually developing change of the muscular structure. This would occur the more easily the longer the functional contracture were retained by an excessive innervation and the resultant squinting position of the eyes were assisted by mechanical factors which favor the same kind of deviation.

The momentous role played by deficiencies of the fusion apparatus in the etiology of squint, must, indeed, be acknowledged unhesitatingly. On the other hand, there is no doubt that even a complete lack of the fusion mechanism cannot cause permanent strabismus in cases in which there is a normal position of rest; that is in orthophoria. They may present an insufficiency of convergence in near vision if the condition is emmetropic or myopic. Or the hyperopic individuals may have a *periodic* concomitant squint for distance, as well as for near, because of the absence of the relative range of convergence. But there is no squint in spite of the lack of fusion so long as they do not mind indistinctness of the retinal images while their hyperopia is not overcome by accommodation.

In most cases of strabismus it is not very difficult to learn which and how many of the main factors first discussed are responsible for the anomaly. If there is any doubt as to whether abnormal innervations take part in the development of a squint, the angle of deviation must be measured several times under equal conditions: the more constant the angle of squint the more likely it is that the deviation is derived from an anatomic mechanical basis. Unsteadiness of the angle of squint points to abnormal, especially spastic, innervations as an essential etiological factor. Such innervations may be intermittent, since spasms come and go at irregular intervals, with more or less complete relaxation. However, even if the spasms are relatively constant, there will never be a constancy comparable to the steadiness of the deviation found in cases in which the deviation is based solely on anatomic-mechanical or on paralytic conditions. This will be substantiated, of course, if the deviation is measured repeatedly, but always in one and the same —usually in the primary—direction of gaze, because there is no case of concomitant squint in which the angle of the deviation does *not* show slight variations in different directions of gaze; for instance, a divergent strabismus will, as a rule, increase in the upper part of the field of fixation while it decreases in the lower part, due to physiologic-mechanical conditions favoring divergence in elevation and convergence in depression of the gaze. Furthermore, in most cases there is a slight decrease in the angle of both convergent and divergent deviations in extreme dextro- as well as levoversion, because the associated external and internal recti even under normal conditions do not respond equally to the impulses.

The unsteadiness of strabismal deviations just discussed must not be misconstrued as a proof of a paralytic origin, for the latter causes the angle of squint to differ according as the paralyzed muscle must participate, more or less, or not at all, in a voluntary movement. In a recent case of paralysis the angle of squint will be found constant if measured at different times for one and the same direction of gaze and its increase or decrease, respectively, in other directions will likewise be found to be constant in repeated tests, in contrast to the unsteadiness of the deviation due to spastic innervations. On the other hand, one must keep in mind that a paralytic deviation does not always retain

its typical features indefinitely. There are many cases in which the paretic muscle regains its function partially or completely without a corresponding decrease of the deviation, because, with the recovery from the paresis, a simultaneous contracture of the antagonist of the paretic muscle takes place. If that contracture is due solely to an increased tonus, it will gradually decrease and finally disappear, provided the pathologic origin causing both the paresis and the functional contracture can be removed. Otherwise, the functional contracture may be transformed into an organic one, due to a change in the muscular structure which can no longer be restored spontaneously. In either case, the deviation maintained by a temporary functional or a permanent organic contracture will not show the original paretic characteristics but those of a concomitant squint, the paretic origin of which can only be surmised from the history, particularly from the sudden and simultaneous appearance of diplopia as well as deviation, but it is no longer evident. Such cases are very instructive in the consideration of the problem in which we are interested because they demonstrate that a deviation of exclusively nervous origin may, in the course of time, either disappear or become fixed, behaving like a squint based on primarily mechanical conditions.

There is another interesting group of strabismus cases the origin of which cannot always be recognized at first glance. In the primary position the visual lines may be either parallel or in a convergent or divergent position, while in either dextro- or levoversion or in either kind of lateroversion the eye that is turned in deviates upward. Thus the patient may show now a left, now a right hypertropia. This behavior would suggest a bilateral paresis of one or both of the superior-oblique muscles, or an overfunction of one or both the inferior-oblique muscles due to a secondary contracture of the latter. The latter condition would seem to be more likely if neither elevation nor depression of the eyes changes the amount of the vertical deviation. Indeed, there are cases of long-standing trochlear palsies which, in the beginning, display the typical paretic signs and symptoms but which gradually develop a concomitant type of vertical deviation that is confined to the nasal periphery of the field of fixation where the oblique muscles have a predominant influence upon the vertical movements, while in the temporal half of the field of fixation in which those movements are governed by the vertical-recti muscles the vertical deviation disappears or is reduced to a minimum. Such behavior must be attributed to a structural change that takes place in the inferior-oblique muscle and maintains a vertical deviation of the concomitant type in the nasal half of the field of fixation, while the paretic superior oblique has regained its function. But in many such cases there are no definite clues pointing to an original trochlear palsy. The vertical deviation may be noticeable only in lateroversion and be combined with either a convergent or a divergent squint, the latter being present in the central part of the field of fixation without the vertical component. Frequently, the anomaly is noticed in earliest childhood and is combined with a habitual torticollis that helps to maintain binocular single vision if the vertical deviation is not combined with a permanent lateral squint. The functional origin of the torticollis is evident from the fact that it disappears if one eye is covered or the balance between the inferior- and the superior-oblique muscles is restored by operative procedures, so that with the head in its normal position binocular single vision is possible. In most of these cases one cannot ascertain

whether the so-called overfunction of the inferior oblique has developed as a secondary contracture of that muscle following a trochlear paresis of congenital origin, or one acquired in early childhood, or whether it is a primary congenital anomaly, or, finally, whether it is due to an anomalous insertion of the internal rectus, giving the function of the latter an elevating besides the adducting component. At any rate, this kind of vertical deviation is based on abnormal mechanical conditions that may be corrected by operative procedures.

Another group of vertical deviations, in contrast to the aforementioned anomaly, is to be attributed solely to abnormal innervations. Patients belonging to this group present the following characteristics: Under the usual conditions of seeing there is either parallelism of the visual lines with binocular single vision, or one kind or another of permanent or periodic squint. But occasionally, for instance, if the patients with binocular vision are tired or their attention is not attracted by visual impressions, one of the eyes will move up; if both eyes have equal vision, they may alternate in that isolated and involuntary upward movement, while if one eye is amblyopic, or blind, only the latter will be seen to move up and down at irregular intervals: a proof that those movements cannot be caused by a fusion tendency which, in cases of hyperphoria, may produce an isolated vertical movement bringing the deviating eye back to binocular fixation. In my investigations on the position of rest in patients who had lost binocular vision through illness or injury, I found in 120 cases (41.5 percent) that, while the normal eye looked straight ahead at an object, there was a striking unsteadiness of the position of the amblyopic eye, which changed its position at irregular intervals, the change being confined almost solely to the vertical component of the deviation. In the second test this component was frequently opposite to that found in the first, while in the third test the vertical deviation was nil or smaller or greater than in the first and second test, respectively. Those one-sided vertical movements, as well as the alternating hyperphorias, are caused by involuntary and intermittent excitations of the nervous centers governing the positive and negative vertical divergence, as I was able to ascertain in my extensive study on that particular kind of vertical movements.[2] They represent a dissociated type of movement because the eyes move in opposite directions independently of the will as well as of the compulsion to fusion. It is amazing how frequently those dissociated innervations occur combined either with some type of heterophoria or strabismus, or as the only anomaly causing a temporary hyperphoria now of the right, now of the left eye. In every case of vertical deviation, either without or combined with a lateral deviation, it is necessary to prove by adequate tests whether the vertical deviation presents the characteristics of the typical concomitant deviations governed by associated innervations, or whether it belongs to the aforementioned group of dissociated vertical divergence. For only the former group can be corrected either by prisms or by operation, since the deviation is caused by an imbalance between the elevator and depressor muscles, whereas such an imbalance does not exist in the latter group, as either both eyes may deviate upward alternately or one and the same eye may turn now upward, now downward. I have seen quite a few patients after the elevator muscles of both eyes had been weakened because the doctor considered the double (alternating) hyperphoria to be caused by an excessive functioning of those muscles due to mechanical conditions. The operative result in such cases had been, and could not be otherwise than a failure, for the nervous irritation

producing that type of vertical divergence does not cease after the operation, the only effect of which is a change of the position of rest. There is no way of eliminating those innervations unless binocular vision can be restored by correcting an anomalous position of rest frequently existing beside the dissociated vertical divergence. A strong fusion apparatus is able to keep the latter latent, so that it becomes manifest only in case of fatigue or exhaustion.

In discussing the etiology of ordinary or concomitant strabismus, I touched upon paralytic squint only with respect to those cases in which the originally paretic features are gradually lost and the deviation assumes the concomitant characteristics. But in only a small minority of cases may the paretic origin of a concomitant squint be inferred from the history, particularly from the statement of a sudden onset of the squint combined with diplopia. There are, likewise, only very few cases of true concomitant squint in which the deviation can be shown to be a congenital anomaly. Congenital deviations, almost without exception, show either deficiencies or irregularities of certain ocular movements that never occur in concomitant squint. On the other hand, there is no doubt that in numerous cases the development of squint is favored or facilitated, respectively, by a congenital disposition. The great part played by heredity in the etiology of strabismus is substantiated beyond any doubt by many statistics. I, personally, know some families in which both parents and all the children were cross-eyed. If only one of the parents squints, at least one of the children, as a rule, will be found to have the same or some other type of strabismus. Very often, indeed, the parents do not squint, but it will be found that one of their brothers, sisters, nephews, or nieces may squint. Moreover, heredity cannot be excluded if nobody in the family is cross-eyed. Carefully compiled statistics have shown that among the nonsquinting relatives of a squinting child much more high ametropia, anisometropia, one-sided amblyopia, heterophoria, or weak fusion faculty is to be met with than in families which have no squinting member; that is to say, the offspring of people affected even with only one or two of the anomalies that play a part in the etiology of strabismus have a much greater chance of acquiring the latter than do other children. A general weakness of the central nervous system, a so-called neuropathic condition, manifesting itself in an abnormal excitability, combined with an abnormal exhaustibility, is found rather frequently as an inherited anomaly in children with convergent strabismus. I am not inclined to consider a neuropathic condition as an important factor in the etiology of ordinary concomitant strabismus, because there are so many squinting children who not only show no signs and symptoms of neuropathic origin but, in addition to excellent physical constitutions, a normal, or even an unusually high degree of intelligence. However, I do not hesitate to admit that the main characteristics of neurasthenia, particularly the combination of abnormal excitability and exhaustibility, are frequently at the bottom of either spasms or insufficiencies of certain innervations, particularly of the convergence, causing *temporary* deviations which are frequently, but wrongly, included in heterophorias. Furthermore, there is no doubt that neuropathic individuals with a slight heterophoria suffer from various subjective troubles, such as headaches, dizziness, diplopia, and so forth, whereas people with a normal nervous system have no symptoms whatever as a result of the same or even a higher degree of heterophoria.

Some authors consider strabismus as a stigma of degeneration relating to an allegedly frequent combination of strabis-

mus and stuttering, left-handedness, and other signs of an abnormal development. According to my experience the above signs of degeneration or of faulty development are no more frequent in squinting individuals than they are in nonsquinting persons. From the history of many cases we learn that convergent squint was noticed after the occurrence in early childhood of one of the general infectious diseases, such as measles, scarlatina, whooping-cough, or other disorders that cause temporary affections of the brain. Considering that the center of the fusion apparatus is one of the most sensitive and vulnerable parts of the cortex, the function of which may be inhibited by mere fatigue or by a psychic shock, it seems very likely that a slight meningitis or encephalitis may cause lasting insufficiency or a total loss of the fusion faculty, depriving patients with a latent squint of the most effective defense against the transformation of a heterophoria into a manifest and permanent strabismus.

In some cases the deficiency of the fusion faculty may be considered to be a congenital disorder. The anatomic basis of the sensorial relationship between the two eyes seems to be absent so that there is only alternating uniocular vision. Such a congenital anomaly would make the peculiar phenomena observed in patients with so-called horror fusionis comprehensible. Most of these patients, who have a squint of one kind or another, do not complain of any discomfort, since their attention is confined to the retinal images of one eye, while those of the other eye are entirely suppressed. But a most annoying diplopia may arise after the deviation has been corrected or reduced, respectively, to a small fraction of that existing previously. Frequently all attempts to get fusion of the double images, either by means of prisms or of the haploscope, fail. The two images may be made to approach, even touch or partly overlap each other, but fusion cannot be brought about since the slightest further change of the position of the two images relative to each other will cause one to move above or below the other, to the opposite side. Such behavior can be explained only by assuming that the patient changes the angle of squint instinctively, in order to avoid a position of his eyes in which the images of the fixated object would be situated on corresponding retinal points, that is, on the two foveae. It seems as if two identical images localized in the same direction without being fused cause such an uncomfortable feeling that the patient, without knowing it, endeavors to avoid it by changing the position of the eyes relative to each other. In such cases the two eyes do not present the halves of a single organ, which is called "Doppelauge" after Hering, but two organs which, in regard to the *sensorial* apparatus, are independent of each other. The frequency of cases of horror fusionis based on a congenital defect has probably been overestimated. Horror fusionis may be due to a prolonged disuse of one eye and the fusion faculty may be capable of being developed by proper training and by a most careful removal of anything which may cause an inferiority of the sensorial apparatus of one eye. I have seen, and published,[3] a striking example of this sort, in which the fusion faculty, in spite of an apparently insuperable horror fusionis, was developed almost completely, but not before a causal connection between a high amount of aniseikonia and the deficiency of fusion had been determined and the difference in the size and shape of the ocular images had been equalized by size lenses. We shall have to look for aniseikonia as a possible origin of the fusional anomaly in cases of weak or defective fusion, particularly when the usual methods of orthoptic training prove to be insuffi-

cient. Aniseikonia seems to be an important factor in the etiology of squint, not only in so far as it involves an incongruence of the ocular images like anisometropia or other conditions prohibiting the sensorial coöperation of the two eyes, but because it may produce anomalous nervous irritations, so that the fusion mechanism may be weakened either in its sensorial portion, since the inequality of the ocular images may favor suppression, or in its motor portion, the functioning of which may be inhibited by a mental antipathy toward the fusion of heterogeneous ocular images. The investigations of aniseikonia, introduced by Professor Ames and the Department of Research in Physiological Optics of the Dartmouth Medical School, are not yet completed. But from the results already obtained through the intimate coöperation of the Department with the Eye Clinic at the Dartmouth Medical School, we may expect valuable progress also with respect to our knowledge of the etiology and the treatment of squint. In most cases, after the eyes had been straightened by an operation so that they could be examined for aniseikonia, a high amount (up to 10 percent and more) of size difference between the images of the two eyes could be ascertained. The amount of both intelligence and attention necessary to make reliable statements in the investigation of aniseikonia is found only in a comparatively small number of squints, so that for the time being we cannot give definite information as to the importance of aniseikonia in the etiology of squint. Professor Ames and his collaborators are continually improving, and at the same time simplifying, the methods of investigation, so that we may hope to be able in the not too distant future to know more about the causal relations between aniseikonia and strabismus.

Our knowledge of the origin of squint is still imperfect. It cannot be satisfactory until we have a better understanding of the peculiar and at the same time contradictory phenomena found in the visual act of strabismus. I cannot discuss them all at this time. Only the most important ones can be touched upon. There is a very significant difference between the strabismus that arises during the first three or four years of life and the strabismus that develops either in later childhood or in adult life. In the former group, the sensorial relationship between the two eyes is nearly always an anomalous one; that is, the two foveae as well as any other pair of corresponding retinal points will not localize images of outlying objects in one identical direction but in different directions, forming an angle which frequently will be found to coincide approximately with the angle of squint. Whereas, if strabismus arises after the fifth year of life retinal correspondence based on innate conditions will, in most cases, be found to be intact in the double image as well as in the afterimage test; double images will be crossed in divergent, uncrossed in convergent strabismus, their separation subtending an angle which corresponds exactly to the angle of squint. And afterimages produced on the foveae will both be localized in one and the same visual direction. There are exceptions to this rule. Some patients at one time show the normal, at another time anomalous retinal correspondence. The latter is frequently very unstable, changing if the angle of squint is changed either spontaneously in the course of time, or by operative procedures; it is frequently superseded by normal correspondence as soon as the eyes have been straightened in such a way as to enable the fusion apparatus to take up its function. From the observations made on the different groups of strabismus, one gets the impression that in cases in which strabismus develops

in early childhood either a congenital or an acquired deficiency of the cortical center governing the fusion movements may be the primary and main cause of the squint. That would imply a rather dubious prognosis as to the restoration of binocular vision. Another rule with many exceptions! You will remember patients who started to squint in the second or third year of life who showed in all tests solely anomalous retinal correspondence. After an operative correction, sometimes immediately and spontaneously, the highest degree of binocular vision took place; a proof that the normal sensorial relationship between the two eyes may be established in earliest childhood without manifesting itself during the time when it is more advantageous for the patients to make use of an anomalous correspondence as the functional substitute for the congenital relationship. The discrepancies found in the visual act of strabismus are hard to understand. They are all the less intelligible because an anomalous correspondence adapted to the angle of squint, contrary to what one would expect in most cases, does not afford even a rudimentary kind of binocular vision. The retinal images of the squinting eye are suppressed just as completely as they are in patients with an intact sensorial correspondence based on innate conditions. In the latter case the suppression prevents diplopia, whereas in the former it prevents the advantage that would be gained by the anomalous correspondence. Thus the question as to the motive for the development of anomalous correspondence in the majority of squint cases remains open, just as the problem of the origin of amblyopia ex anopsia is still unsolved. As we know from clinical experience the visual acuity of an amblyopic squinting eye can be improved, sometimes even increased up to normal vision. But we do not know why such an eye, which originally had normal vision, has become amblyopic, or has even lost central fixation, while the vision of the squinting eye of other persons remains unimpaired, and why in other cases the squinting eye which from the first had only a fraction of normal vision, keeps that fraction unimpaired during a period of many years. Until the answer to these and other questions has been given we cannot get to the bottom of the etiology of squint and will not be able to obtain the ideal therapeutic results at which we are aiming.

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In the discussion of this paper read before the Washington, D.C., Ophthalmological Society, the questions asked by Dr. Frank D. Costenbader were answered as follows:

1. Is there a reasonable explanation for the greatly exaggerated convergence seen in some cases when a moderate amount of accommodative effort is exerted?

The exaggerated convergence in cases of strabismus with a comparatively small amount of hyperopia may be caused either by the coincidence of the hyperopia with an anomalous (convergent) position of rest due to anatomic-mechanical factors, or by a so-called diplopiaphobia (van der Hoeve), that is, by a voluntary convergence effort increasing the deviation in order to shift the retinal image of the squinting eye from a paracentral to a peripheral area, so that, because of the poorer vision of the periphery the image is less disturbing and more easily suppressed.

2. Can any estimate of the percentage of truly congenital fusion deficiency be given?

The percentage of truly congenital fusion deficiency cannot be estimated, but it has very likely been overestimated. In the majority of such cases the deficiency may be acquired in early childhood, due to a cerebral lesion occurring in general infectious diseases. Not infrequently, the deficiency of fusion has turned out to be a functional anomaly due to the long disuse of the squinting eye. Binocular vision may be restored by removing the deviation and eliminating any other factors which may interfere with binocular vision, such as anisometropia or aniseikonia.

3. Is there a definite difference between the so-called double hyperphoria seen in a mild paresis of both superior recti and that classed as "dissociated" by the speaker?

There is a very definite difference between the so-called double hyperphoria and a mild paresis of both superior-recti muscles. In the former case, either eye when covered deviates upward so that right and left hyperphoria alternate with each other. In a mild but unequal paresis of both superior recti the eye with the weaker superior rectus will be deviated downward either continually or temporarily, while the other eye when covered will turn upward, so that there will be either right hyperphoria or left hypophoria but *never* an alternating (double) hyperphoria as long as the eyes continue to look at an object straight ahead. Levoversion in such a case will always cause right hyperphoria, which will be transformed into left hyperphoria if the eyes move to the right, whereas true double hyperphoria is independent of the direction of gaze. (An analogous behavior will be found in pareses of both inferior recti.) Decisive for the diagnosis of a dissociated vertical deviation is the isolated downward movement of the covered eye elicited by a darkening glass put before the fixating eye, so that a left hyperphoria, for instance, will be transformed into a left hypophoria without the right eye's giving up fixation. As to the details of the experiment I must refer to my aforementioned article on dissociated vertical divergence.[3]

4. How often is abnormal retinal correspondence adapted to the angle of squint?

Anomalous retinal correspondence will be found in the great majority of cases in which strabismus has arisen in early childhood. The discrepancy between the objective angle of squint and the separation of the double images is one of the characteristics of anomalous retinal correspondence. The latter is adapted to the angle of squint only in a minority of cases. The anomalous correspondence may have developed at a time when the angle of squint was either smaller or greater than at the time of the examination. In such a case there is neither binocular single vision, as could be expected in cases where anomalous correspondence is adapted to the angle of squint, nor does the distance between the double images correspond to the objective deviation.

CHRONIC TUBERCULOUS UVEITIS*

Clinical and anatomic observations in fellow eyes

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History and clinical record

A colored woman, 50 years old, first applied to the Eye Dispensary of Washington University School of Medicine, November 18, 1930, because of inflammation and disturbed sight in the left eye. The patient had first noticed the vision in this eye to be clouded about six weeks previously. Examination of the right eye revealed only several semilunar deeply vascularized scars in the cornea near its periphery. Vision of the right eye was 6/5 with correction (+1.25 D. sph. ⊂ +1.00 D. cyl. ax. 140°).

Examination of the left eye disclosed a small opacity in the upper outer quadrant of the cornea. Slitlamp examination showed many precipitates on the posterior surface of the cornea, many cells in the anterior chamber, dense, gray, round nodules, projecting anteriorly from the iris stroma in a diffuse manner, posterior synechiae, many small tags of iris on the anterior surface of the lens, a very irregular pupil, and a cloudy lens. Examination with the ophthalmoscope disclosed so many vitreous opacities that no details of the fundus could be distinquished. Vision in the left eye was ability to see motion of the hand at one foot. Examinations in the clinics for medicine, gynecology, and chest, as well as in the endocrine, the otolaryngology, and dental clinics, were negative as to any possible source of the eye trouble. The clinic for medicine found an aortic insufficiency from an aortitis and a secondary cardiac hypertrophy.

On December 17, 1930, intradermic injections of old tuberculin were started, beginning with 0.000001 mg. No reaction was obtained until 0.1 mg. was used, when it was noted that five or six of the nodules in the stroma of the iris had enlarged. Therapeutic injections of tuberculin were delayed principally because the patient did not return regularly. Between February 11 and February 19, 1931, the patient was in Barnes Hospital for exposure to ultraviolet radiation. In spite of repeated Kahn tests of the blood and one of the spinal fluid being negative, antisyphilitic treatment was instituted for several weeks with mixed treatment by mouth, intramuscular injections of mercuric succinimide and 0.3 gm. of neoarsphenamine intravenously. By May 20, 1931, the small round nodules in the iris had diminished in number and by June 12th the precipitates on Descemet's membrane had practically disappeared. Definite softening of the eye was noted by July 6, 1931. At about that time pain in the eye at intervals became intense. The left eye was enucleated July 23d.

The right eye had vision of 6/5 with correction and showed no changes on August 17, 1931. A week later, vision with correction was 6/20; some cells were present in the anterior chamber. The patient did not return until January 11, 1932, when there were noted numerous precipitates on the posterior surface of cornea, a few small spots of pigment on the anterior surface of the lens, and many fine floating opacities in the vitreous. Placed again in Barnes Hospital, intravenous injections of typhoid-paratyphoid vaccine were given between January 16

* Read before the Section on Ophthalmology of the American Medical Association at Kansas City, Mo., May, 1936.

and February 10, 1932, and the tonsils were removed February 2, 1932. Considerable improvement apparently resulted from these measures, because vision of 1/60 on entering the hospital had increased to 6/12 with correction when the patient left the hospital February 13, 1932. Unfortunately by the last of March, 1932, the vision with correction had dropped to 6/30. Examination of the eye revealed many precipitates on the posterior surface of the cornea, many cells in the anterior chamber, and a thickened and dull iris. Three minims of Coley's fluid was injected on March 26 and 29, 1932; the second injection was followed by a very severe reaction. The condition of the right eye thereafter gradually became worse and the vision was light perception on September 26, 1932. In Barnes Hospital between September 28 and October 20, 1932, another course of injections of typhoid-paratyphoid vaccine was carried out. A thin pupillary membrane and posterior synechiae had so completely bound the pupillary margin of the iris to the anterior surface of the lens as to produce increased intraocular tension and considerable pain. Relief of the latter was temporarily obtained by repeated paracenteses. On September 30, 1932, there were observed many tiny tubercles or elevations over the iris, particularly in a circular zone about 2 mm. from the pupillary border. Because of uncontrollable pain and the loss of all vision, the right eye was removed November 5, 1932.

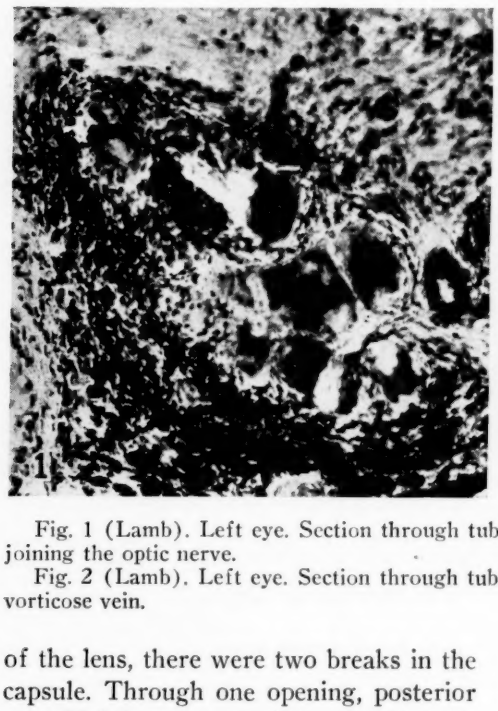
Both eyeballs were fixed in a 10-percent solution of formaldehyde and imbedded in celloidin; horizontal sections were stained with hematoxylin-eosin and a combination of Verhoeff's elastic tissue and Van Gieson's differential stain for collagenous tissue.

Anatomic observations in left eye

Macroscopic. The eyeball was much shrunken. The anterior and the vitreous chambers contained considerable albuminous fluid. The retina was generally detached and wrinkled, which was probably due to the shrinking of the eyeball.

Microscopic. The cornea contained numerous deeply lying capillaries and small lymphocytes between the lamellae of the substantia propria. No precipitates were present on the posterior surface of the cornea. The filtration networks at the iris angle contained dense numbers of macrophages. (The iris angles were open, although the anterior chamber was shallow as the result of the shrinking of the eyeball.) The iris was diffusely infiltrated in a moderate degree with plasma cells and macrophages. Many of the small capillaries of the iris showed proliferation of their endothelial lining and the presence of macrophages closely surrounding the vessels. In the blood stream of some of these capillaries, numerous monocytes as well as pus cells were observed. In places on the anterior surface of the iris were collections of macrophages. On the nasal side, a large collection of epithelioid cells behind the sphincter-pupillae muscle had proliferated through the posterior pigmented epithelium, producing a large gap in the latter. On each side near the base of the iris, a very large collection of epithelioid cells occupied the anterior two thirds of the thickness of the iris; a giant cell was present in each of these nodules. On the temporal side, the iris at its base was much thickened by dense numbers of plasma cells and macrophages. The iris angle was entirely closed on this side by this thickening of the iris. The adjacent anterior emissary blood vessels and anterior part of the suprachoroidal space were coated and filled with dense numbers of plasma cells and macrophages. A thin pupillary membrane filled much of the pupil. On both sides, a thin narrow annulus of posterior synechial connective tissue and pigmented epithelium of the iris lay on the anterior

lens capsule. From the latter on the nasal side, a layer of pigmented epithelium had proliferated to cover partly the pupillary membrane. Many pigmented cells from the pigmented epithelium of the iris were observed in the posterior synechia and in the pupillary membrane. The pupillary space also contained considerable albuminous fluid and many red blood cells. In the central part of the anterior capsule was mild. On the temporal side, the unpigmented ciliary epithelium over the orbiculus ciliaris had proliferated inward to a pronounced degree. Much cystic degeneration was present in this hyperplastic epithelium. Large macrophages present here along the inner surface of the ciliary body were probably derived from the proliferated unpigmented ciliary epithelial cells and from the macrophages



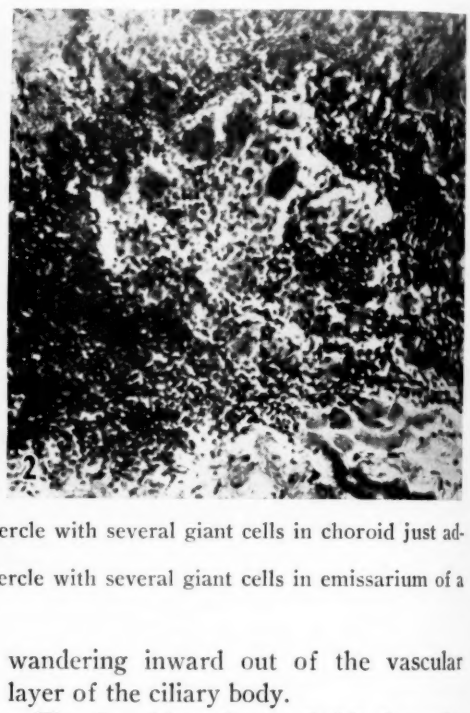


Fig. 1 (Lamb). Left eye. Section through tubercle with several giant cells in choroid just adjoining the optic nerve.

Fig. 2 (Lamb). Left eye. Section through tubercle with several giant cells in emissarium of a vorticose vein.

of the lens, there were two breaks in the capsule. Through one opening, posterior synechial tissue was proliferating into the lens. As a consequence of the breaks in the capsule, liquefaction of the lens fibers was taking place superficially in the anterior cortex of the lens. Posteriorly, liquefaction of cortical lens fibers was noted superficially around the posterior pole.

The ciliary body on the temporal side was infiltrated in its vascular layer and stroma of the ciliary processes with moderately dense numbers of plasma cells and macrophages; on the nasal side, infiltration with these cells in the same situations wandering inward out of the vascular layer of the ciliary body.

The choroid on the nasal side showed a scanty diffuse infiltration with small lymphocytes and plasma cells and a few large dense foci of the same cells and varying-sized collections of epithelioid cells; the latter might lie to either the inner or outer side of the choroid. In several places, a large group of dense numbers of epithelioid cells had broken through the lamina vitrea and the pigmented epithelium. Just to each side of the optic nerve a medium-sized nodule (fig. 1) containing a large collection of epithelioid cells and numerous giant cells

on the inner side of the choroid had broken through the lamina vitrea and the pigment epithelium. On the temporal side the choroid was generally thickened by very dense infiltration with plasma cells and macrophages, enclosing in numerous places large collections of dense numbers of epithelioid cells and an occasional giant cell. Varying intensities of caseation were observed in several of the largest groups of epithelioid cells. In several places, large collections of epithelioid cells had produced a disintegration of the pigmented epithelium. Posteriorly near the optic nerve on the temporal side, a thick layer of dense connective tissue lay along the inner surface of the choroid. Under this connective tissue, the pigmented epithelium was either absent, disintegrating, or hyperplastic. Numerous fibroblasts but only a few capillaries were present in this connective tissue. In some sections, proliferated pigmented epithelium and pigmented spindle-shaped cells were observed in this connective tissue. Under this layer of connective tissue, the choroid showed an infiltration with plasma cells and macrophages, varying in intensity from a moderate to an intensive degree. The latter condition obtained away from the optic nerve, where two very large nodules of plasma cells and macrophages enclosed large collections of epithelioid cells and a few giant cells; over one of these nodules, the lamina vitrea had been broken through for a considerable extent.

The retina, although completely detached and much wrinkled, lay generally near to the pigment epithelium. The retina presented a secondary, diffusely arranged and fine cystic degeneration. Many of the retinal blood vessels showed thin coatings of macrophages. The latter were present in scanty numbers in the vitreous along the inner surface of the retina.

The optic papilla was very edematous. The central retinal vessels in the papilla showed in places thick coatings with dense numbers of macrophages.

The posterior emissaria on the temporal side were surrounded in several instances by large, dense collections of small lymphocytes; at one place a large group of epithelioid with a few giant cells was present (fig. 2).

The diagnosis in the left eye was as follows: Clinically, the large nodules in the iris are probably indicative more of tuberculosis than anything else. Anatomically, in the choroid, specific tuberculous nodules are present. The infiltration in the uveal tract also is generally focal or nodular in this eye.

Anatomic observations in right eye

Macroscopic. The eyeball was not shrunken, and the sclera where unthickened by cellular infiltration was thinner than normal. The anterior chamber was very shallow, owing to the presence of a thin pupillary membrane. The lens did not adhere to the iris but lay considerably posterior to the iris, forming a very deep posterior chamber. The latter was partly explained by a definite dislocation backward of the lens, but at the time the tension was elevated the lens must have been adherent to the pupillary membrane. The ciliary body and choroid were generally thickened by dense cellular infiltration (fig. 3). The latter was also present generally around the anterior equatorial and posterior emissaria, along the anterior ciliary vessels in the tendons of the two lateral-rectus muscles and focally in the sclera. The retina was largely detached; on the temporal side the detached retina was only a little separated from the pigment epithelium. Albuminous fluid was present in the anterior, posterior, and vitreous chambers as well as under the detached retina.

Microscopic. Deeply lying capillaries

extended for a considerable distance into the periphery of the cornea. A moderate intensity of small lymphocytes and plasma cells was observed between the corneal lamellae near the temporal corneoscleral junction.

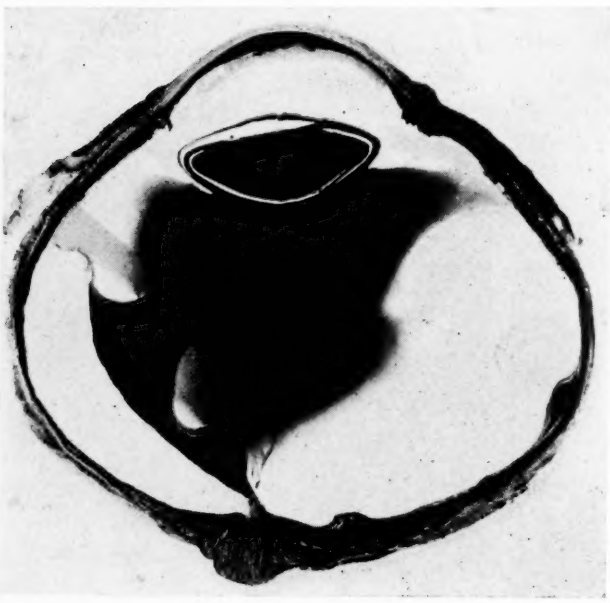


Fig. 3 (Lamb). Right eye. Section through eyeball showing diffuse dark-colored cellular infiltration in the uveal tract and anteriorly in the sclera.

The iris was generally not thickened but showed everywhere a moderately intense to an intensive infiltration with plasma cells and macrophages. Small islands of epithelioid cells were frequently observed in any part or level of the iris stroma. On the anterior surface of the iris occurred numerous macrophages. Besides the thin pupillary membrane there was observed, continuous with it, a narrow annulus of connective tissue attached to the posterior surface of the iris at the pupillary margin. Both the latter and the pupillary membrane contained many young fibroblasts, macrophages, pigmented epithelial cells, and chromatophores. As a result of the cellular infiltration, the iris was considerably atrophic, and the pigmented epithelial layer was rapidly losing melanin. Behind the iris near its base there was generally present a varying thick layer of exudate composed of macrophages, young fibroblasts, and a few pigmented epithelial cells; in places the base of the iris was thickened by the prevailing cellular infiltration in the iris, and the posterior pigmented epithelium was disintegrated or absent over small areas.

The vascular layer of the ciliary body in its outer part was densely infiltrated with plasma cells and macrophages. The posterior half of the ciliary body was much thickened by this cellular infiltration, which here involved all the ciliary body external to the pigmented epithelial layer; here in the vascular layer were observed small islands of epithelioid cells with an occasional giant cell (fig. 4). Over the posterior part of the orbiculus ciliaris, the unpigmented ciliary epithelium was hyperplastic and cystically degenerated. Wandering through this hyperplastic unpigmented ciliary epithelium from the vascular layer of the ciliary body were varyingly dense numbers of macrophages. Here on the temporal side and close to the unpigmented ciliary epithelium lay a thin cyclitic membrane containing many macrophages and young fibroblasts. In places, the posterior part of the pigmented ciliary epithelium was disintegrating or absent.

The choroidal changes were characterized by a generally diffuse thickening with dense numbers of plasma cells and macrophages. On the nasal side, just be-

hind the equator, there was present at the inner part of the diffusely infiltrated and thickened choroid, a large collection of epithelioid cells which had broken through the lamina vitrea and the pigment epithelium. On each side of the optic nerve, small collections of epithelioid cells with a few giant cells appeared at the inner part of the densely infiltrated choroid; here they had broken through the lamina vitrea and the pigmented epithelium of the retina. To the temporal side of the optic nerve, the choroid over a large area was diffusely and considerably thickened by very dense infiltration with small lymphocytes, plasma cells, and macrophages. Many large and small islands of epithelioid cells were present midway and at the inner side of the thickened choroid; among the epithelioid cells, an occasional giant cell was observed. No caseation was found. Except at a point just adjacent to the optic nerve, the lamina vitrea was not ruptured, and few inflammatory cells were situated internal to it over this diffusely infiltrated area in the choroid. In several places over the choroid, a thin layer of new-formed connective tissue was present on the inner surface of the choroid. The pigmented epithelium was hyperplastic to a moderate degree in many places.

The retina showed generally a diffuse secondary cystic degeneration. The macular region of the retina was sharply and considerably detached inward, with albuminous fluid lying not only under the retina here but also filling the external plexiform layer and, indeed, the entire foveola; lateral to this region, numerous globular foci of albuminous fluid lay in the external plexiform layer. The blood vessels in the retina and optic papilla presented thick coatings with small lymphocytes and macrophages. The optic nerve was moderately atrophic.

Around the anterior equatorial and posterior emissaria generally were dense coatings of small lymphocytes and macrophages. In many places near the emissaria, dense infiltration of the sclera with small lymphocytes and plasma cells was observed. This infiltration of the sclera

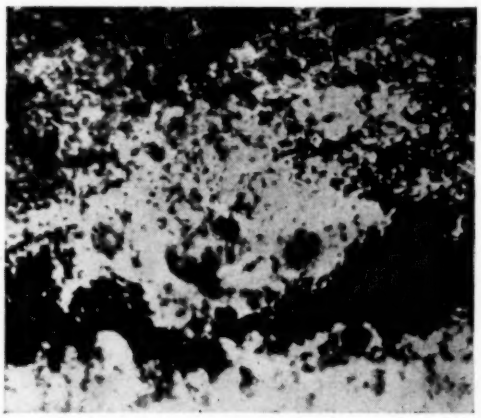


Fig. 4 (Lamb). Right eye. Section through tubercle with three giant cells in the ciliary body.

was particularly pronounced in the region of the equator and anteriorly on the nasal side. In the region of the equator on the nasal side, small islands of epithelioid cells and an occasional giant cell were observed among dense numbers of round cells infiltrating the sclera. In several foci, partial caseation was present. A considerable amount of hemorrhage was found here between the scleral lamellae. The involvement of the sclera was probably only an extension of the process surrounding the emissaria. There was present in the bulbar conjunctiva adjoining the corneoscleral junction very dense infiltration with small lymphocytes and plasma cells. This infiltration extended backwards around the anterior ciliary blood vessels onto the tendons of the lateral and medial rectus muscles.

The diagnosis in the right eye was as follows: The infiltration in the uvea of this eye is essentially diffuse. The nodules of epithelioid cells in the anterior part of

the iris and those breaking through the lamina vitrea of the choroid could hardly be other than tuberculous. The extensive diffuse, small, round-cell infiltration with islands of epithelioid cells and an occasional giant cell to the temporal side of the optic nerve is most typical of sympathetic disease, particularly in view of the generally unruptured lamina vitrea. The extension of the round-cell infiltration from the uveal tract outward around the emissaria is also more characteristic of sympathetic ophthalmia. The scleritis is much more likely to be tuberculous, particularly the specific nodules near the equator on the nasal side. It must be admitted that all the changes in this eye could be tuberculous. It is true that the changes in the uvea of this eye are not typically tuberculous but, as repeatedly stated by authorities in ocular pathology, any variety of uveal infiltration may be due to tuberculosis.

Conclusions

This case is a typical example of chronic ocular tuberculosis as emphasized by F. H. Verhoeff.* According to this writer, a condition is established in these cases in which the tissues of the host and the infecting organisms have become relatively tolerant to each other. The characteristic features in these cases are the following: Chronic ocular tuberculosis almost never occurs in cases in which there are well-marked clinical signs of systemic tuberculosis. Although chronic ocular tuberculosis is rare compared with the incidence of tuberculosis in general, yet when it occurs it is almost always sooner or later bilateral. It occurs almost exclusively in adults and far more frequently in females. The temperature is almost never elevated and is often subnormal. A large dose of tuberculin is usually required to produce a constitutional reaction and rarely a tuberculin reaction cannot be obtained at all. Animal inoculations of the lesions usually if not always give negative results.

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* Verhoeff, F. H. Chronic ocular tuberculosis. Jour. Amer. Med. Assoc., 1914, v. 63, July 4, p. 13.

THE USE OF CONCENTRATED-EPINEPHRIN PREPARATIONS IN GLAUCOMA, IRITIS, AND RELATED CONDITIONS*

A CLINICAL STUDY

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The action, effects, and clinical use of epinephrin in various forms has been the subject of numerous contributions since Wessely first described its effective lowering of intraocular tension. The subject is well covered by the reports of many distinguished writers including Gifford,[1] Gradle,[2] C. Hamburger,[3] Thiel,[4] Post,[5] Howell,[6] and numerous others. Still it seems justifiable to report our experiences in the clinical use of this agent in a large number of cases of different types encountered in the course of several years' office practice. The study of these cases and of some of the excellent recent articles in the literature enables us to form and present some fairly definite ideas as to what one may expect in different kinds of cases.

One of the most important lessons we have learned is that any given case may respond in an entirely unexpected manner and that concentrated epinephrin should first be used only where the patient can be kept under observation for an hour or more after its first application. If no ill effect is noted in this period, usually none will arise later.

The preparations we have used which are suitable for office use are:

1. Epinephrin hydrochloride, 1:1000 solution. This is used by subconjunctival injection. One-fifth to one-third cubic centimeter injected at the limbus is a powerful mydriatic and causes a marked lowering of intraocular pressure. The latter effect does not pass for 48 to 72 hours and may last even longer. This is true both of normal eyes and of those with simple glaucoma.

The unpleasant systemic effects of palpitation of the heart, tremor, sweating, coldness of the extremities, rising blood pressure, weakness, vomiting, or even collapse are more probable with subconjunctival injections than with other methods of administration though they may follow in any case regardless of method employed.

Those suffering with toxic goitre or diabetes and sympathicotonic individuals are most susceptible to these unpleasant effects. Our experience, as that of others, indicates that there is little actual danger to life and that repeated use of the remedy leads to lessening of these reactions.

2. Epinephrin hydrochloride solution may be introduced into the conjunctival sac by well-saturated cotton tampons wound on a smooth applicator after the method of Gradle. The effect is somewhat less marked than after subconjunctival injection, but still wide mydriasis and marked lowering of tension follows.

3. Epinephrin bitartrate is available in the American market in glass ampoules containing .091 gm. (.05 gm. active principle). This may be employed as: (a) Solution. One ampoule dissolved in 4.5 c.c. distilled water gives the 2-percent solution ordinarily referred to. Stronger or weaker solutions may be employed. This solution is rapidly discolored and is unfit for use after ten days or two weeks. Employed as drops in the conjunctival sac

* From the Department of Ophthalmology, Washington University. Read before the American Academy of Ophthalmology and Otolaryngology, 41st annual convention, in New York, October 1, 1936.

or by cotton tampons, it has powerful action as a mydriatic and in lowering tension. (b) Ointment of epinephrin, using equal parts of petrolatum and lanolin as a base in 4.5-gm. or 9-gm. tubes gives a 2-percent or 1-percent product that is stable and convenient to use, employing the same amount of epinephrin.

The action following the instillation of the salve into the conjunctival sac is more gradual and less violent than after the use of similar concentrations in solution. The salve is retained longer in the sac; hence the effect is more prolonged. Systemic symptoms are not so liable to follow but are not unknown. (c) Epinephrin bitartrate in tragacanth jelly in concentration of 1 percent or 2 percent, dispensed in tubes, provides a stable, convenient means of application.

This preparation was described by one[7] of us at the meeting of the American Academy of Ophthalmology and Otolaryngology in Chicago, in 1934. This, as stated at that time, is a convenient and economical method of use both for office and prescription purposes. The rapidity of action seems to be between that of the solution and the ointment of like concentration. After using the jelly several weeks or months, some patients develop a conjunctival sensitiveness to it. The ointment may then be substituted for it.

4. Glaucosan (Links) as described by Hamburger is a 2-percent solution of laevo-epinephrin with a similar amount of one of the preliminary substances developed in the production of synthetic epinephrin, methylanimoaceto-brenzcatechin.

This preparation is said to give the mydriatic and tension-lowering effects of epinephrin without the unpleasant systemic results. It is unstable and is to be used only immediately after opening the ampoule, thereby making its use a matter of very considerable expense.

Since beginning the use of the epinephrin bitartrate in jelly form, our employment of this agent has increased many times because of the convenience of having a stable preparation always at hand and of being able to prescribe it economically for home use.

Chronic simple glaucoma is the disease in which many writers on the subject have found epinephrin concentrates most useful.

Darier noted the tension-lowering effect of adrenal extracts in glaucomatous eyes and recommended their use with miotics.

Rubert described the three-phase effect of epinephrin on the ocular tension: first, a slight drop; second, a brief rise; third, in glaucoma, a drop lasting often several days.

MacCallan, Jessop, and Seun early warned against unrestricted use on account of danger of acute rise of tension in some cases. Erdmann recommended adrenalin as a means of prolonging and enhancing the effect of miotics.

Thiel, by careful clinical observation, determined the pressure curve after epinephrin in simple glaucoma. His method was to measure the pressure at 7-8 a.m., then instill the salve three times at one-hour intervals, at 8, 9, and 10 a.m., after which the tension was measured frequently for several days. He described a three-phase effect: 1st phase. The pupil dilates in 20 to 30 minutes, reaching its maximum size in two to three hours. The ocular pressure is generally unchanged, at times there is a slight fall, or perhaps an acute rise. 2d phase. From noon to early evening an abrupt fall of tension; the lowest point may be reached the next morning. 3d phase. The pupil slowly contracts to its original size in 72 hours. The tension rises slowly. The effect varies as to duration from two or three days to as many weeks.

The explanation of these effects that seems most acceptable is as follows:

The early rise of tension is due to dilatation of the pupil. The first lowering of

pressure is due to vasoconstriction, reducing the arterial supply and draining the previously engorged choroidal vessels. The prolonged lowering of pressure is due to secondary paralysis of uveal-tract vessels increasing venous drainage and quickening the blood flow.

Our experience with epinephrin preparations in chronic simple glaucoma was not so encouraging as to lead to its adoption as a routine measure. In many cases in which it was tried there was little or no response. Our practice tended, therefore, to employ miotics for a period and to recommend early operation. Only in cases in which operation was to be avoided for some special reason did we use epinephrin in conjunction with miotics for prolonged periods. We found it useful in re-activating the eye to miotics after the latter had seemed to lose effect.

**Case 1.* Mrs. M. B., aged 67 years, had a Lagrange operation in 1933 for chronic secondary glaucoma, which led to loss of vision in the right eye after a long course of treatment and repeated operations. The left eye remained unaffected until May, 1934, when tension was 33, vision normal. Under the influence of pilocarpine in increasing strengths, the tension remained near normal level, frequently rising to 30 or 33, even during the use of pilocarpine 4 percent. On February 25, 1936, the tention was 26. Epinephrin bitartrate 2-percent salve was instilled. The tension in one hour was 22. This salve was prescribed for home use twice daily with pilocarpin 4-percent solution three times a day. The tension remained constantly 16 to 22 except when epinephrin was omitted. On April 4, 1936, the tension was was 37 and eserine 1 percent in castor oil was prescribed to be used with epinephrin. The tension has been well controlled at a level of 18 by alternating pilocarpine solution with the eserine preparation and by using epinephrin twice daily up to September 10, 1936. It is probable that this will cease to be effective and operation will be necessary.

The effectiveness of epinephrin as an adjuvant to the miotics is illustrated in the following history:

Case 2. E. J. D., aged 30 years, was examined October 10, 1930. Symptoms were dull headaches; halos. The tension was 37 in each eye, the vision normal. Pilocarpine solution in increasing strengths was used till November 7, 1930, when the tension was 33. Pilocarpine 2-percent solution was instilled in each eye with no reduction of tension in one-half hour. Glaucosan (Links) drops were used and in one hour tension was 22 in each eye. Pilocarpine 1-percent solution was used three times daily, the tension remaining at this level until the date of operation, two weeks later, when bilateral trephining was performed. The tension and vision were normal four months later without treatment.

After operation for glaucoma there may be a rise of tension difficult to control by use of miotics. Such a case may respond to epinephrin.

Case 3. W. L., aged 55 years, had a left blind eye; in the right eye vision had been failing two years. The field was contracted; vision 5/7.5; the disc had a deep glaucomatous cup; the tension was 26. A trephining operation on the right eye took place on November 14, 1933. On December 11, 1933, the tension in the right eye was 37.

Miotics were used vigorously until August 20, 1934, with tension fluctuating from 22 to 37. Epinephrin bitartrate 2 percent in jelly was prescribed for use twice daily. Tension at once dropped to 26 and remained so until the time when the patient was last seen, January 28, 1936, under continued use of epinephrin jelly twice daily.

*Note. The numerals denoting tension in this article indicate millimeters of mercury as measured by the Schiötz tonometer.

Case 4. Mrs. A. L., aged 47 years, had acute glaucoma in the left eye in 1929, relieved by miotics, but developed a chronic glaucomatous state with tension fluctuating from 22 to 50 under treatment with pilocarpine and eserine until November 25, 1935, when a trephining operation was performed. On December 5, 1935, the tension again rose and remained in a range of 26 to 30, under use of eserine 1 percent in oil four times daily. Epinephrin 2 percent in jelly was instilled. One-half hour later the tension was 22. The jelly was prescribed for use once daily. Eserine was discontinued, and the tension remained constantly at 18; all medication was gradually withdrawn by March 5, 1936. When last seen, on July 29, 1936, the tension was normal.

Chronic simple glaucoma may be transformed into an acute fulminating attack by epinephrin used once. This fact is now well known and mentioned by many writers on the subject. The following case impressed it upon us many years ago.

Case 5. Mrs. J. D., aged 75 years, suffered an attack of acute congestive glaucoma in the right eye in August, 1926. This was relieved by trephining and the eye remained quiet with normal tension. On October 23, 1929, the patient appeared with a tension of 47 in the left eye, but without other signs. Vision was 5/6. Glaucosan (Links) drops were instilled. Before reaching home the patient experienced an acute congestive attack with a tension at 60. It was partially relieved by frequent use of miotics and heat. A week later the tension was 37. A trephining operation led to a gradual quieting of the eye. The tension remained normal to date. Vision was reduced to 5/30 by lens opacities.

Chronic secondary glaucoma with uveitis is a type of case in which epinephrin concentrates are not recommended generally. Nevertheless we have had occasional good results and consider their use if miotics are not effective. If the tension rises while the patient is kept in the office for observation, as he should be, paracentesis at the limbus followed by eserine ointment serves to bring relief.

Case 6. Mrs. H. P., aged 70 years, was seen October 28, 1935, by Dr. W. E. Muldoon, who noted episcleral redness, tension 20, cornea clear. On November 18, 1935, he reported the lower third of the cornea clouded in all layers, striation of Descemet's membrane, homogeneous deposit on the posterior surface. Tension was 30. Miotics had been used.

On December 3, 1935, we found the corneal epithelium edematous, with blebs and an ulcer. The tension was 26. A paracentesis was performed. On December 6, 1935, the tension was 30. Epinephrin bitartrate 2 percent in jelly was placed in the sac. One hour later the tension had dropped to 24. This preparation was prescribed for home use three times daily. The tension remained at 18 to 22 until January 28, 1936, and treatment was discontinued. No further rise has been noted.

In acute secondary glaucoma with uveitis, epinephrin may be helpful or may lead to a painful rise in tension. It is our practice to attempt to reduce the tension by miotics and hot fomentations while treating the uveitis vigorously by constitutional measures, the most effective of which is the use of typhoid vaccine intravenously in nonspecific cases. Dilating the pupil by epinephrin serves to prevent adhesions and may reduce tension.

Case 7. Dr. A. C. H., aged 48 years, was first seen on November 28, 1931, having had an eye red and painful for two days. The tension was 55. The use of eserine 0.5 percent and pilocarpine 1 percent alternately every 1½ hours reduced the tension to 37 in two days. The vision remained 5/6. Glaucosan (Links) drops dilated the pupil, and in one hour the

tension was 33. Epinephrin chloride, 1:1000 solution, was prescribed to be used by tampons at home. Next day there was much pain; the tension was 47. Eserine alkaloid, 1 percent in castor oil, was prescribed. This produced a fall of tension to 37, but in two days there was a rise to 47 and a well-defined uveitis was present. A Lagrange operation for glaucoma was followed by satisfactory recovery.

Case 8, seen this summer, illustrates another valuable manner of using this drug.

R. G., aged 52 years, was referred at his own suggestion because he wished to avoid an operation for glaucoma recommended by his local oculist. He had suffered a mild iritis for three weeks which had at first responded to local and general measures only to develop a painful rise of tension to 55 on the day he was referred. By evening, the use of eserine and hot fomentations was followed by a drop in tension to 26. Their continued use at two-hour intervals with a bacterial antigen intramuscularly quieted the eye and the patient returned home with a tension of 18 and only a few cells in the aqueous. Almost complete recovery was interrupted four weeks later by pain, deep ciliary redness, and very heavy pigmented adhesions of the contracted pupillary border to the lens. The tension remained low. The aqueous was filled with clumps of cells and showed a marked flare in the slitlamp beam.

Epinephrin bitartrate, 2 percent in jelly base, caused severe pain but only slight dilation of pupil at one point in two hours. A second instillation with addition of atropine powder was made and a dressing applied for two hours. Atropine alkaloid 1 percent and cocaine, 1 percent in oil, were prescribed for use every two hours.

The next day the pupil was still small, the tension low; but a few more adhesions had yielded. Epinephrin solution 1:1000 and atropine 1 percent were then injected subconjunctivally and dilated the lower half of the pupil to a width of 4 mm. in two hours. Epinephrin jelly was again instilled, and a dressing applied for two hours. Atropine and cocaine oil were used every two hours at the hotel. Next day the pupil was again small, but the aqueous much clearer. Adhesions were present across the top of the pupil. The patient was then sent to the hospital where the same line of local treatment was augmented by the intravenous use of typhoid vaccine. Each morning the pupil would be small until the epinephrin jelly was applied although atropine was used each two hours. By the fourth day all adhesions were broken and the pupil was round. Most of the redness and all the pain were gone. Only a few cells remained. It was thought that only the powerful dilating effect of the concentrated epinephrin had enabled us to break up these very dense adhesions; at the same time its influence in reducing tension was of value.

Our experience with epinephrin in cases of acute glaucoma agrees with that reported in numerous articles. In the beginning we used it persistently in several cases; occasionally it produced a drop in tension of a few points after an hour or two but caused intense pain, and at other times it increased pressure. A review of some of our records of early cases confirms the opinion that acute congestive glaucoma is a contraindication to the use of any form of epinephrin.

Following the needling of soft cataracts in young adults, the tension often rises as the lens substance pushes forward into the anterior chamber.

We have used epinephrin in several such cases, as tampons, Glaucosan (Links) drops, such as epinephrin bitartrate, 2-percent jelly, with gratifying re-

sults. We quote only one of our early experiences.

Case 9. Miss C. T., a teacher, aged 31 years, had a needling of a congenital cataract followed in 24 hours by marked rise of tension with pain and redness. Epinephrin chloride 1:1000 was applied on well-soaked tampons several times daily. In 48 hours the tension was low and absorption proceeded without further complication.

One of the most difficult types of glaucoma to relieve is that following cataract extraction. This most often occurs after the needling of secondary capsular membranes with herniation of vitreous into the aqueous chamber. It is well known that such cases often do not respond to operative measures nor to the use of miotics. Many of them go on to complete blindness in spite of all treatment. We have used epinephrin bitartrate, 2-percent jelly, in many of these cases with gratifying results. Practically none of them have shown a rise of tension even on first application. Several have reached a state of apparently permanent low tension without further use of medication. Some require continued use of miotics along with epinephrin. A few illustrative cases are cited.

Case 10. A. E. H., aged 40 years, had a mature cataract of complicated type in the left eye in October, 1931. A mild glaucoma developed and the cataract was extracted, extracapsularly, in May, 1932. Needling of the capsular membrane in July, 1932, resulted in vision of 5/6 but the tension ran a stubborn up-and-down curve under vigorous use of eserine and pilocarpine along with two operative procedures—iridencleisis in September, 1934, and in May, 1935. In September, 1935, the tension ranged about 30 under the regular use of eserine, and the eye was red and irritable. The use of epinephrin bitartrate, 2-percent jelly, was followed by a fall of the tension to 22. It was used twice daily for one month with tension constantly at 16 to 18 when treatment was stopped, September 30, 1935. No further rise of tension occurred until January 4, 1936, when following a blow by a soft ball, the tension was found to be 43. Epinephrin, 2-percent jelly, again was used twice daily, followed by a tension of 22, at which point it remained without further treatment.

Case 11. J. L. R., aged 69 years, had a cataract extraction in August, 1935. One month later the eye was quiet; vision was 5/10. A month after this he suffered a small hemorrhage into the vitreous reducing vision to 5/60; the tension was 43. After several days' treatment with miotics, epinephrin, 2-percent jelly, was instilled and prescribed for use twice daily. Two days later the tension was 26. In one week, the tension was 18; vision 5/5. The patient was last seen one month later; the condition remained unchanged.

Case 12. Mrs. J. M., aged 39 years, had leukoma of the cornea and cataracts as the result of a reaction from eyelash dye. Cataract extraction was performed in March, 1934; iridocapsulotomy, September 4, 1934. The next day, the tension was 37. Under the use of miotics the tension varied from 22 to 37 until April 18, 1936, when it was 33. Epinephrin bitartrate, 2-percent jelly, was used once daily with pilocarpine 1 percent twice daily. The tension became and remained normal, being 22 when the patient was last seen on June 9, 1936.

Case 13. Mrs. O. W. F. had a needling of an aftercataract capsular membrane on January 10, 1936. Tension rose the next day and remained up under the use of eserine and hot fomentations. On January 13th, the tension was 43. Epinephrin bitartrate, 2-percent jelly, was instilled. On the next day, the tension was 37; there were also pain and blurred vision. Epinephrin again was used. Some

cardiac distress followed, with rapid pulse and tremor. In one-half hour the tension was 26 and the eye comfortable. On January 15th, the tension was 30; the patient used only eserine. She was given epinephrin jelly to use three times daily at home. On January 17th, the tension had dropped to 18. This treatment was continued for two months, increasing the intervals, and then stopped. Tension remained the same on all visits and vision slowly cleared. When last seen two months after treatment was discontinued, May 4, 1936, the tension was still 18; the vision 5/6.

Numerous similar cases could be cited. Some respond after very brief treatment, some maintain normal tension by use of epinephrin ointment alone, and others require both ointment and miotics. Some, of course, do not yield to any combination of measures and continue to blindness. In this group of cases, recognized as most difficult to handle, we feel that strong epinephrin preparations, especially in water-soluble ointment, is a very valuable therapeutic adjunct.

The use of suprarenin in cases of iritis with synechiae as an adjuvant to atropine in securing dilatation and freeing adhesions is well illustrated in case 8. It has been so used in many of our private cases and by the staff of the Washington University Out-Patient Department in a great number of staff cases. Its use is usually followed by considerable pain as the adhesions break away, but this can be controlled by sedatives. Acute rise of tension in this type of case is rare.

Summary

We have recorded here something of our experience over a period of years, in using strong epinephrin preparations in the treatment of many and varied cases. This experience and the rich literature on the subject have brought us to certain conclusions which we believe constitute a fairly comprehensive set of working rules for the use of this valuable therapeutic agent.

1. Concentrated epinephrin is a powerful mydriatic capable of lowering ocular tension, or of producing an acute rise of tension, of causing severe pain, and occasionally unpleasant general symptoms; hence, the first use should be made where the patient can be observed for one or more hours.

2. Epinephrin is a valuable aid in cases of chronic simple glaucoma in which miotics must be used for prolonged periods in lieu of the preferred surgical measures.

3. Chronic secondary glaucoma generally does not yield to epinephrin but may do so, and a trial is justified.

4. After operation for glaucoma, epinephrin may be effective in securing a state in which the tension remains normal for long periods without treatment.

5. Glaucoma, after needling of cataracts and aftercataract membranes, has been controlled in a large percentage of cases by epinephrin with or without miotics.

6. Epinephrin is invaluable in breaking up adhesions in cases of iritis and uveitis.

7. The most convenient form for office and prescription use is as an ointment in a water-soluble base (tragacanth jelly) or in an oily base (petrolatum and lanolin).

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ADRENALIN CHLORIDE 1:100 IN OPHTHALMOLOGY

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The first effective use of a suprarenin product to obtain mydriasis and reduce intraocular pressure was by means of subconjunctival injections.[1] Since, however, the use of the hypodermic needle was disconcerting to many patients and the amount of the drug introduced occasionally produced severe systemic reactions the attempt was made to find a substitute for the injections. A small wick of cotton saturated with a solution of adrenalin chloride 1:1000 was placed in the upper conjunctival fornix (Gradle[2]), and solutions of synthetic products were developed (glaucosan[3] and suprarenin bitartrate[4]) of such high concentration as to be equally effective when instilled in the form of drops into the conjunctival sac. John Green[5] in 1930 first reported upon a solution of adrenalin chloride supplied him for experimental purposes in strengths of 1:100 and 1:500, which he used as drops in the conjunctival sac in 15 cases. Since his report we have found no further mention of it in the literature until June, 1935, when Graeser and Rowe[6] reported, at the meeting of the Association for the Study of Allergy at Atlantic City, on a new method of administering adrenalin chloride for prompt relief of certain allergic conditions. They found that a 1:100 solution was frequently effective in the relief of bronchial paroxysm. In August, 1935, adrenalin-chloride solution 1:100 was first supplied to the medical profession to be used in the mouth only, for inhalation by means of a glass nebulizer.

It occurred to us that this same adrenalin-chloride preparation could be used as drops in the conjunctival sac and since December, 1935, we have thus employed it with most satisfactory results in over 100 cases. In our hands it appears to have well substituted for the subconjunctival injections of adrenalin chloride 1:1000 and the synthetic epinephrine preparations mentioned above. Its use has been particularly gratifying in cases of secondary glaucoma associated with uveitis, as a mydriatic in certain cases suspected of glaucoma, in cases such as of retinal detachment in which maximal mydriasis is required, and in cases of acute or subacute iritis in which drastic mydriasis is indicated. To enhance its effectiveness it is advisable to place the patient in a recumbent position and instill the drop from above, the patient looking downward. Recently we have obtained an interesting effect in a case of sympathetic ophthalmia. Its use in the latter, as an alternate medicament, will be elaborated in the case report below. In another case the solution

of adrenalin 1:100 applied to the nose of a chronic sneezer whose sneezing could not be controlled by any other means, eliminated serious hazards and made possible the safe performance of a cataract operation.

Report of cases

Case 1. Mrs. E. A. P., aged 67 years, reported in December, 1935, complaining of blurred vision in the right eye for the past six weeks and of right temporal headache in the last two days. The vision was 0.3. Slitlamp microscopy showed a few deposits on Descemet's membrane. There were many vitreous opacities masking fundus details. The visual field was normal. Intraocular tension was 70 mm. Hg (McLean). The depth of the anterior chamber was normal. Examination of the angle of the anterior chamber with our microgonioscopic technique[7] showed the angle to be open, but it appeared as if the pores of the sclerocorneal trabeculum were blocked by exudate, thus causing the increased tension. Diagnosis: uveitis with secondary glaucoma. Instillation of drops of adrenalin 1:100 reduced the tension to 45 mm. within one hour, and there was immediate relief of the headache. Daily instillations were continued in the office for a period of 11 days, after which time the tension remained normalized without further treatment. When last tested nearly one year afterwards the tension and vision were normal.

Summary: Glaucoma secondary to uveitis was beneficially influenced by the instillation of drops of adrenalin 1:100 in the conjunctival sac. The increased intraocular pressure appears to have been caused by blockage with exudate of the pores of the sclerocorneal trabeculum. There was evidence to suggest that as a result of stoppage of further exudation and of absorption of the exudate already present, free circulation of intraocular fluid was restored and thus normal intraocular pressure reëstablished.

Case 2. Mr. J. B., aged 58 years, was seen in Septemer, 1936, having a beginning sympathetic ophthalmia in the right eye. There had been right temporo-frontal headache for the past three days. In April the left eye had suffered a perforating injury, followed by iritis. He had been under the care of a colleague but had failed to return for frequent observation. The left blind eye, which showed a plastic iritis and was hypotonic, was immediately enucleated. Vision of the right eye was 0.4, correctable to 1.0—2. There were many fine deposits on Descemet's membrane. Intraocular tension was 90 mm. Hg (McLean). The anterior chamber was of normal depth, suggesting that the increased intraocular pressure was due as in the previous case to blockage of the pores of the trabeculum through exudate. A solution of eserine 1 percent was instilled every three hours, reducing the tension to 50 mm. Treatment by adrenalin 1:100 in the office daily for the first few weeks and subsequently three times a week combined with one-eighth percent eserine three times daily at home has kept the tension normalized to date (five months). In this way surgical interference, which is so unwelcome in sympathetic ophthalmia, has been avoided. Present vision in the right eye is 1.0, corrected; the visual field is normal except for a Seidel's sign which is decreasing in size. There have been no fresh deposits on the posterior surface of the cornea, nor has there been any formation of posterior synechiae or of a pupillary membrane.

Summary: This case illustrates the tension-lowering property of adrenalin 1:100. It also calls to mind its possible therapeutic value in lessening exudation in cases of sympathetic ophthalmia, thus

tending to prevent occlusion of the pupil as well as glaucoma secondary to blockage of the pores of the sclerocorneal trabeculum.

Case 3. Mrs. B. W. P., aged 48 years, reported in June, 1935, for cataract surgery. There was a history of fits of violent sneezing two or three times daily which she had never been able to control. She had consulted several physicians in the past 18 years and was unable to obtain any relief. Before undertaking surgery, we referred her to a rhinologist and an allergist. A diagnosis of hyperesthetic rhinitis was made—no allergy was present. Thyroid-ovarian extract was given internally and normal salt and ephedrine nose drops used for two weeks without effect. A nasal spray of cocaine solution failed to alleviate the sneezing. We then cautiously tried adrenalin 1:100 in the P.D. Nebulizer as a nasal spray, with the pleasing result of immediate cessation of sneezing. When we had convinced ourselves by repeated trials of the efficacy of this treatment the cataract operation was successfully performed, the sneezing being completely controlled for several days before and after operation. The patient made an uneventful recovery.

Summary: This case presented a serious hazard for cataract surgery which was eliminated by the use of adrenalin 1:100.

Observations on the Action of Adrenalin Chloride 1:100 in Glaucoma Secondary to Uveitis

It has been our clinical impression in several instances of uveitis, of which cases 1 and 2 are examples, that exudation was markedly reduced following constriction of the vessels of the iris by adrenalin and that as a result of this, further blocking of the pores of the trabeculum was prevented. Soon after the application of the adrenalin chloride such deposits as were present on Decemet's membrane showed signs of absorption. Microgonioscopic investigations suggest that presumably a similar process of absorption occurred in the exudate that was blocking the trabeculum. The therapeutic effect of adrenalin chloride (as well as that of similar products) would accordingly appear to be made up of several factors:

1. Reduction of the intraocular pressure due to constriction of vessels and diminution of secretion.
2. Dilation of the pupil.
3. Arrest of exudation and thereby prevention of further blockage of the pores of the trabeculum leading to Schlemm's canal.
4. Shrinkage of the root of the iris and of the ciliary body. This keeps the filtration angle open and the entrance to the angle wide in the presence of mydriasis. Thus the formation of peripheral adhesions of the iris to the wall of the angle is prevented.

It is a well-known clinical fact that increased intraocular pressure retards the progress of uveitis. Per contra it is understandable that adrenalin chloride should exert a beneficial influence on the course of uveitis through its pressure-reducing effect.

Conclusion

For the past year we have been using adrenaline chloride 1:100 in the form of drops in the conjunctival sac as a satisfactory substitute for adrenalin 1:1000 (subconjunctival injections and wicks) and for the synthetic products glaucosan and suprarenin bitartrate. Adrenalin 1:100 possesses the advantage of being a natural product and has proved stable to the extent that we have not as yet found it necessary to set a time limit on its effectiveness. It is not necessary to precede its

instillation by anesthetizing drops. There have been no systemic reactions, neither conjunctival nor corneal irritations, nor any trophic disturbance of the tissues. In common with the synthetic products, however, there may be an occasional initial rise in tension, for which reason we have confined its administration in the eye to the office under personal supervision and do not believe it should be prescribed for home use. It sometimes is ineffective in normal eyes. As is also the case with the other preparations, it may be used in conjunction with mydriatics to increase their effectiveness. In certain cases of chronic glaucoma in which the increased tension is no longer sufficiently influenced by miotics, after lowering the tension with adrenalin 1:100, the original miotic will occasionally be found again to exert its beneficial influence.

In conclusion some suggestions are made, based on clinical and microgonioscopic evidence, on the therapeutic action and indications for the use of adrenalin chloride 1:100 in glaucoma secondary to uveitis, and in certain other ophthalmic conditions.

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THE SPERMINE BASES OF OCULAR TISSUES*

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The life of the ocular tissues is obviously too complex to be centered around a few simple substances. Many chemical compounds occur in the water-soluble extracts of the various tissues, although frequently the reports on the general chemistry of the eye apparently overlook this fact. In the soluble extracts, the nitrogenous bases are an important fraction. Of the twenty or more bases occurring in the ocular tissues, this communication is concerned with two, spermine and spermidine, which occur in relatively small quantities.

Crystals of spermine phosphate in human semen were seen and well described in 1678 by Leeuwenhoek[1] in his famous communication on the discovery of spermatozoa to the Royal Society in London. In 1791 Vauquelin, at the time of his work on the analysis of tears, attempted to investigate the nature of spermine phosphate. Subsequently, in 1833 Berzelius, who was then curious about the chemistry of the eye, believed that the crystals consisted of an inorganic phosphate. In 1865 Böttcher rediscovered the crystals, which were then named after him. Schreiner in 1878 noted that Böttcher's crystals were formed on old pathological specimens which had been kept in alcohol. It became gradually established from this time on that the substance was a phosphate of an organic base. It is only recently that Rosenheim[2] and his coworkers determined the chemical structure of spermine and spermidine and isolated these substances from various organs.

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METHOD

Fresh ocular tissue of the ox was ground, weighed, and then dried on a water bath. Alcohol was occasionally added to hasten the drying. After it had been weighed the dried material was extracted with ether. To the extracted tissue was added nine volumes of 2.5 percent trichloracetic acid. The mixture was shaken and then filtered. A mixture of equal volumes of filtrate and of a saturated solution of picric acid was heated on a water bath until clear, and then cooled slowly. After twelve hours the precipitate was removed quantitatively, dried in air, and then dissolved in a minimal quantity of boiling alcohol acidified with hydrochloric acid. Ten volumes of acetone was added. After maximal precipitation had occurred, the picric acid was removed with acetone, and the crystals were dissolved in a minimal quantity of boiling water, and an aqueous solution of saturated diammonium phosphate was added until the pH of the solution was 7.1. Alcohol was added until the solution was 25 percent alcohol by volume. After 24 hours the precipitate of spermine phosphate was removed and washed with a solution of 25 percent alcohol. The crystals were dried and weighed. To the filtrate sufficient alcohol was added to make the volume 50 percent alcohol. The spermidine phosphate which then was precipitated was tested in the same manner as the spermine phosphate.

The concentration of spermine bases was similar whether the usual 50-gram or 1000-gram samples of tissue were used. Extraction with chloroform of strongly alkaline aqueous extracts of tissues gave similar yields in percentage of spermine bases.[3]

For ultimate analysis each substance was recrystallized to remove any impurities. From 15.5 to 15.7 percent phosphorus, 14.2 percent nitrogen, and 20.6 percent water were found in the spermine phosphate obtained from choroid, iris, retina, corneal epithelium, and brain. The theoretical analysis is 15.6 percent phosphorus and 14.1 percent nitrogen. The melting point of spermine phosphate of each tissue was 228-233°C. (cor.) as compared with the melting point of 230-234°C. (cor.) of a sample of recrystallized spermine phosphate which was obtained from Hoffman-La Roche, Switzerland.

The spermidine from the iris contained 15.8 percent phosphorus and 14.2 percent nitrogen, corresponding well with the theoretical 15.9 percent phosphorus and 14.4 percent nitrogen. The melting point of the phosphate isolated from iris and brain was 205°C. (cor.) The sample of recrystallized spermidine phosphate which was obtained from Hoffmann-La Roche was 206-207°C. (cor.)

TABLE 1

SPERMINE AND SPERMIDINE IN MG. PER 100 GRAMS OF BOVINE OCULAR TISSUE

Conjunctiva		Sclera		Corneal Epithelium		Corneal Stroma		Whole Cornea		Choroid	
Spermine		Spermine		Spermine		Spermine		Spermine		Spermine	
Wet	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet	Dry
2.3	7.9	0.1	0.34	47.7	211.4	<0.2	—	6.8	24.2	3.5	9.7
2.1	8.4	0.3	1.2	40.1	202.6	<0.3	—	8.8	38.5	4.2	14.1
2.9	9.6	0.1	0.48			<0.1	—	4.9	20.4	3.1	10.4
										3.7	12.6
Iris		Optic Nerve		Retina		Lens		Vitreous Humor		Brain	
Spermine		Spermine		Spermine		Spermine		Spermine		Spermine	
Wet	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet	Dry
35.0	184	5.8	18.0	31.8	246	3.0	7.6	0	—	4.4	18.9
35.5	208	4.3	17.2	26.4	219	4.3	11.7	0	—	4.6	16.7
38.1	226	5.5	19.4	34.6	226	5.8	18.0	0	—		
36.8	184	4.6	14.7	30.6	235	3.5	9.2	0	—		
36.3	198			26.2	261	2.9	7.7				
Spermidine										Spermidine	
Wet	Dry									Wet	Dry
1.30	6.6									0.06	0.31
1.67	7.4										
1.54	8.3										

NOTE: Spermidine was found only in the tissues as recorded. The retinal pigment epithelium was removed with the choroid. The cornea without epithelium was recorded as stroma.

The crystals of the spermine bases of the ocular tissues showed the same physical and optical properties as those obtained from Hoffmann-La Roche for comparison.

DISCUSSION

The results of the analysis for spermine and spermidine are given in table 1 in mg. per 100 grams of fresh and dry ocular tissues. Only in the brain and iris could spermidine be found, although the

combined extracts of the tissues of several thousand eyes were used. There seems to be no relation of spermidine to spermine which depends upon the structure or function of these two issues. No spermine was found in many kilograms of vitreous humor. Evidently the substance is retained in the living tissue and is not diffusible. Only small quantities of spermine were obtained from conjunctiva, choroid, sclera, lens, optic nerve, and brain. Practically none was found in the corneal stroma. The spermine of the stroma as recorded in table 1 is evidently contained in the corneal endothelium. Large amounts were obtained from corneal epithelium, iris, and retina, which are tissues showing high metabolic activity.

Spermine, α-δ (γ-amino-propyl-amino) butane, is apparently a common constituent of animal tissues. A similar compound, spermidine (γ-amino-propyl-amino)-γ amino-butane is commonly associated in small quantities with spermine and, as may be noted from the above formula, it is structurally related to spermine.

Indirectly it is probable that these two substances like the other basic organic compounds are metabolic products that arise from the breaking down of amino acids in the tissue or that are synthetized from amino acids through some vital process. It is likely that the diaminobutane group may be derived from the decomposition of the amino acid, arginine, into urea and ornithine. The latter substance is decarboxylated and forms putresine (diaminobutane). The amino propane group may result from the loss of carbon dioxide from the amino acid, α-amino-n-butyric acid. Thus spermine and spermidine may be formed from the conjugation of the two groups resulting from the decomposition of two amino acids.

It appears probable that spermine phosphate exists as such in the tissues in an undiffusible form. Since it occurs in such varying amounts it must play some important role in metabolism, although as yet no demonstrable function has been discovered.

SUMMARY

A quantitative analysis of the spermine and spermidine in bovine conjunctiva, sclera, corneal epithelium and stroma, choroid, iris, vitreous humor, retina, optic nerve, and brain was made. There is reason to believe that these substances take a part in some unknown important physiological function of active metabolic tisues.

The technical procedures were performed with the aid of Mr. W. Tauber.

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PARACENTESIS AND ATROPINE IN THE TREATMENT OF OPTIC AND RETINAL ATROPHIES*

PRELIMINARY REPORT

M. L. FOLK, M.D.
Chicago

The treatment of optic atrophy, regardless of the type, has been a great disappointment to physicians in general and to the ophthalmologist in particular. The same is true of the treatment of retinal atrophy, which, as to type, in our present discussion, will be limited to pigmentary degeneration, or retinitis pigmentosa. It is no wonder, therefore, that from the earliest times of modern medicine, efforts have been made to improve upon the treatment of these ocular diseases by means of drugs, surgery, or physical agents.

Among the drugs, the antiluetic remedies and the vasodilators, such as the nitrates, have been used with varying success, but, on the whole, unsatisfactorily. Indeed, when salvarsan was first discovered it was hoped that it would at least stay the progress of the luetic atrophies; however, it proved to be of value in only a limited number of cases. Nonspecific protein therapy, such as malaria, typhoid vaccine, and tuberculin, have had their advocates, but here, too, the results have been unsatisfactory. Of the surgical procedures attempted, paracentesis, Elliot trephining, Lagrange sclerectomy, aspiration of the vitreous, and, of late, paracarotid sympathectomy may be enumerated. The last-named procedure, while hailed as a great success in Europe, has brought rather discouraging results in this country. Galvanic current, roentgen rays, and hyperpyrexia by diathermy have, on the whole, shown similar results.

The principle involved in the various forms of therapy enumerated was to produce a hyperemia and an increased blood supply to the still-intact optic-nerve fibers. With this in mind, Samkowski[1] treated a number of cases of luetic optic atrophy with retrobulbar injections of atropine, hoping to produce a local hyperemia in the orbit. Most authorities, however, especially Gapeeff,[2] Maslenikoff,[3] and Abadie[4] believe that the action of atropine is central in origin and that it can be administered just as effectively by the intravenous or hypodermic route. Abadie verified the work of Charcot; namely, that the progressive type of optic atrophy described by Von Graefe was due to a spasm of the central artery of the retina. This spasm he believed to be secondary to one of the ciliospinal center, which is situated at the level of the first two dorsal vertebrae and sends off fibers to the central retinal artery and to the pupil. For that reason he started in 1923 the use of atropine intravenously and reported some good results. Mariotti and Lugli[5] in 1931 also reported beneficial effects from the use of atropine in six out of 11 cases.

My interest in this subject was aroused by an abstract appearing in the Archives of Ophthalmology, issue of September, 1934, in which encouraging results were reported in various types of optic atrophy and retinitis pigmentosa from the use of paracentesis of the anterior chamber and hypodermic injections of atropine. I had at the time a private patient suffering from luetic optic atrophy in whom I had a personal interest and who had shown intolerance to tryparsamide and no response to other antisyphilitic remedies. I

* From the Department of Ophthalmology, the University of Illinois, College of Medicine. Read before the Chicago Ophthalmological Society, November 16, 1936.

Fig. 1a

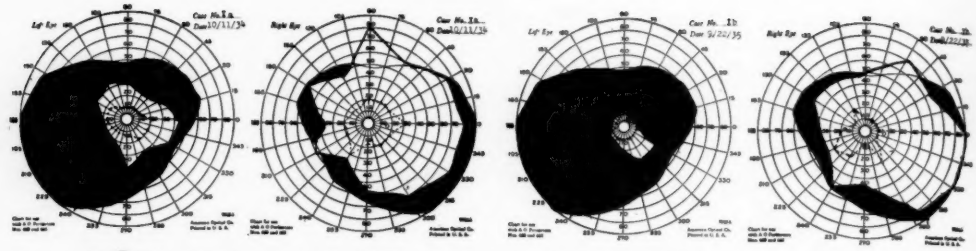

Fig. 1c

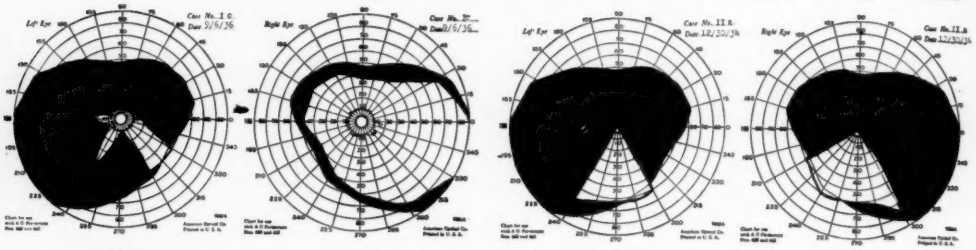

Fig. 2b

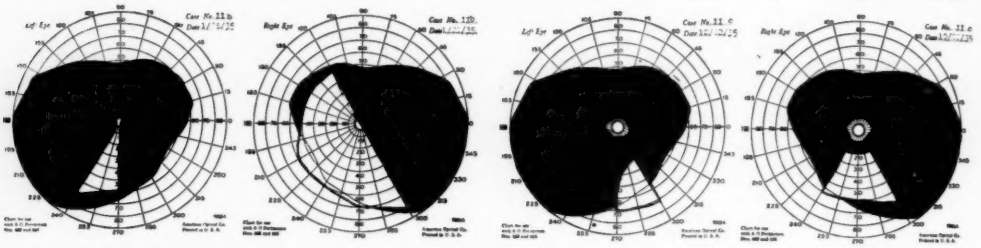

Fig. 3a

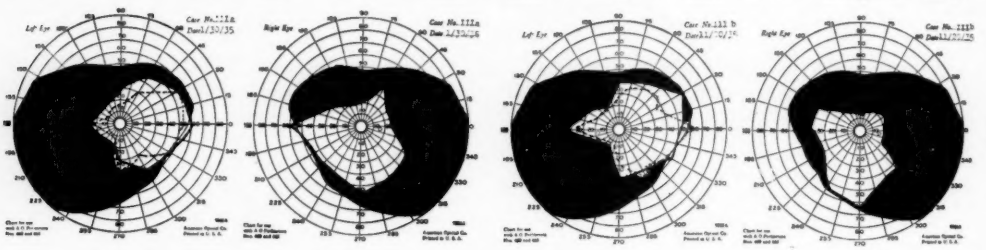

Fig. 4a

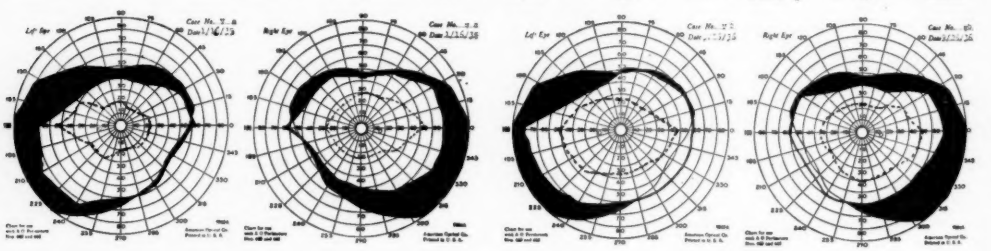

Fig. 1 (Folk). Case I. a, Fields before treatment was begun. b, Fields after first series of treatments. c, Fields on last examination.

Fig. 2 (Folk). Case II. a, Fields before treatment was begun. b, Fields after first series of treatments. c, Fields on last examination.

Fig. 3 (Folk). Case III. a, Fields taken before treatment was begun. b, Fields 9 months after series of treatments.

Fig. 4 (Folk). Case V. a, Fields taken before treatment was begun. b, Fields at the last examination.

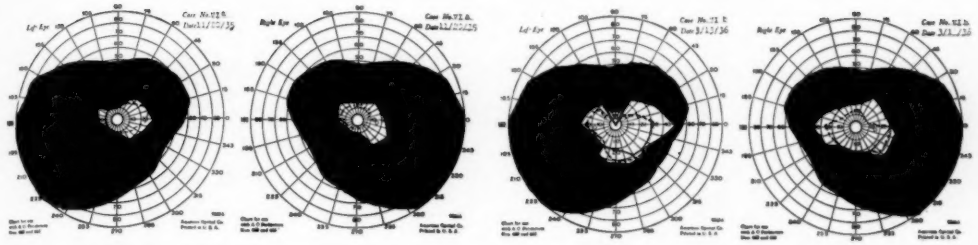

Fig. 5a Fig. 5b

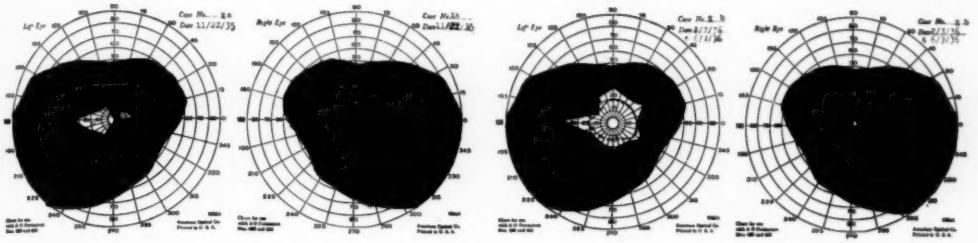

Fig. 6a Fig. 6b

Fig. 5 (Folk). Case VI. a, Fields taken before treatment was begun. b, Fields taken after last treatment.

Fig. 6 (Folk). Case X. a, Fields taken before treatment was begun. b, Fields after first series of treatments and on last examination.

secured a copy of the original article published in Archivio di Ottalmologia contributed by Dr. Mario Vele[6] who is a voluntary assistant in the clinic of Professor Gallenga. It was the latter, a great proponent of paracentesis for various ocular diseases, who suggested to Dr. Vele to combine this procedure with atropine hypodermically so as to obtain both local hyperemia and also dilatation of capillaries throughout the body, including the retina. An additional effect of paracenteses, he argued, would be the repeated formation of new aqueous, which we know is beneficial to diseased ocular structures. Accordingly, Dr. Vele used this treatment in 24 cases of various types of optic atrophy, including three cases of retinitis pigmentosa, and obtained improvement in the visual acuity, visual fields, or both in 18 out of the 24, or in 75 percent of the cases. I suggested this treatment to my patient, who readily concented to be a subject for experimentation, and, at the same time, I began to carry out the same treatment in a group of cases at our clinic at the University of Illinois. To date a total of 10 cases of optic and retinal atrophies have been treated in patients who have been regular in their attendance and have received the treatment as outlined below. Several other patients started the treatment but did not go beyond a few injections and are, therefore, not included in this series.

The treatment was carried out exactly as suggested by Dr. Vele. During the first week 0.3 c.c. of a sterile atropine-sulphate solution 1 :1000 was given hypodermically on alternate days, so as to establish the tolerance of the patient for atropine. In the meantime, one or two paracenteses of the anterior chamber were performed on the days when the patient received no atropine. If the patient showed no untoward effects from the atropine, the amount was increased to 0.4 and, finally, to 0.5 c.c., and this was given daily, beginning with the second week (except when paracentesis was done) and continued until a total of 30 to 40 injections had been given and six paracenteses per-

formed. In the luetic case the antiluetic treatment was vigorously carried on in the meantime. Tabulation of the cases and the visual fields follow: (Unless specified the form field is 5/330 and the red field is 8/330.)

ment in the visual acuity, one remained stationary, and one showed a decrease in vision in spite of the treatment. The visual fields improved in three and remained stationary in one. In one case no fields could be obtained, for the vision was limited to

TABLE 1. TABULATION OF DATA AND RESULTS OF TREATMENT

Case Number	Diagnosis	Age	Sex	Vision on First Examination	Number of Paracenteses	Number of Atropine Injections
I	Primary optic atrophy, luetic bilateral	42	M	R. 20/100 L. 20/65−1	3 of each eye	40
II	Retinitis pigmentosa, secondary atrophy	60	M	R. 3/200 L. 8/200	2 of right 4 of left	30
III	Primary optic atrophy, bilateral	41	M	R. fgs. L. 20/15−2	5 of right eye	30
IV	Retrobulbar neuritis with temporal pallor	18	F	R. 20/100 L. 20/65	refused	36
V	Optic atrophy early, luetic	51	M	R. 20/15 L. 20/15−2	2 of each eye	30
VI	Retinitis pigmentosa with optic atrophy	42	F	R. 20/200 L. 10/200	3 of each eye	35
VII	Primary optic atrophy, luetic	53	F	R. blind L. 20/65	5 of right eye	29 at irregular intervals.
VIII	Retrobulbar neuritis, secondary atrophy	49	M	R. 5/200 L. 3/200	15 injections of sodium nitrite	15
IX	Optic atrophy, primary, luetic	62	M	R. light perception L. hand movements	3 of each eye	30
X	Optic atrophy, luetic, advanced	44	M	R. 12/200 L. 20/50+1	3 of each eye	33

SUMMARY OF CLINICAL INVESTIGATION

A series of 10 cases of various types of optic atrophy and retinitis pigmentosa was treated by a combination of repeated paracenteses of the anterior chamber and intravenous injections of atropine. They are conveniently divided into three groups:

1. Group one—six cases of luetic optic atrophy. Of these, four showed improvehand movements. The patient in case 7 showed poor coöperation and received no antiluetic treatment, the field becoming worse in spite of treatment. All the rest of the patients continued to receive antiluetic treatment.

2. The second group consisted of two cases of advanced retinitis pigmentosa. Both showed only temporary improve-

ment in the vision and visual fields, and the treatment had to be repeated within a few months.

3. The third group consisted of two patients having retrobulbar neuritis with secondary optic atrophy. The pathology but none in the visual fields.

The period of observation of the patients in this series ranged from two to 23 months, the average being about 10 months. None of these cases showed untoward effects from either the atropine

IN 10 CASES OF OPTIC-NERVE AND RETINAL DISEASE

Vision After First Course of Treatment	Visual Fields	Retrogression and Repetition of Course		Vision at Last Examination	Visual Fields at Last Examination	Period of Observation
		Interval	No. of injections			
R. 20/100+1 L. 20/30	Stationary	8 months	40	R. 20/100 L. 20/40	Stationary	23 months
R. 12/200 L. 20/200	Improved	6 months	25	R. 3/200 L. 10/200	Stationary	21 months
R. 11/200 L. 20/13−3	Slight improvement in left eye	None	None	R. 11/200 L. 20/13−3	Slight improvement in left eye	10 months
Same as before treatment	Relative central scotoma	None	None			12 months
R. 20/13−1 L. 20/15−4	Slight improvement	8 months	30	R. 20/20+3 L. 20/13	Slight improvement	9½ months
Unchanged	Slight improvement	7 months	26	R. 20/100−1 L. 20/100−1	Stationary	21 months
L.V. 20/200	Worse	None	None			2 months
R. 10/200 L. 8/200	No change	None	None	No improvement		3 months
Unchanged	No fields obtained	None	None	No improvement	No improvement	3 months
R. 20/100 L. 20/40	Improved	None	None	R. 20/100 L. 20/40	Improved	7 months

was of unknown origin in one; the other was a diabetic and a heavy smoker. In addition, the neurologic department suspected tabes, although the blood and spinal Wassermann tests were negative. These patients refused paracenteses so the treatment was limited to atropine alone. One showed no change; the other, a slight improvement in the visual acuity

or the paracenteses, and the latter were performed on many occasions at the office or in the outpatient department.

Conclusions

It is obvious that no definite conclusions can be drawn from this investigation: first, because the number of cases is too small; second, because the period of

observation is too short, and third, because no control group has been observed. However, certain impressions can be obtained even from a small series such as this, and my impressions may be stated as follows: (1) Cases of luetic optic atrophy in the early stages seem to be definitely benefited by the combined treatment of paracenteses and atropine. (2) Fairly advanced cases seem to derive only a slight benefit or at least a stay in the progress of the atrophy. (3) Well-advanced cases show no improvement at all. (4) In retinitis pigmentosa the improvement from the treatment is of only a temporary nature and the atropine has to be often repeated. (This thoroughly agrees with the views of Dr. Vele.) (5) Secondary atrophy following retrobulbar neuritis seems to receive very little benefit, if any, from the treatment. (6) The treatment is simple and harmless.

This adjuvant in the treatment of optic atrophy is brought to the attention of the ophthalmologists of this country for the sole purpose of stimulating further clinical investigation so that a larger series may be accumulated from which more definite conclusions could be reached. The writer hopes to carry on this work and render a final report in the near future.

I wish to express my gratitude to Dr. Joseph Carbone of the interne staff of the Michael Reese Hospital for his able translation of the original article from the Italian.*

25 East Washington Street.

* Since the date of completion of this paper, several articles have appeared in the German and one in the American literature by Cordes (Amer. Jour. Ophth., 1937, Jan., p. 53) on the treatment of optic atrophy by the retrobulbar injection of atropine.

The writer has had no personal experience with this method but is familiar with the work of the late Dr. S. F. Suker, at the Cook County Hospital of Chicago, several years ago, which proved unsatisfactory. After a few injections the treatment became painful, sometimes causing a severe proptosis, so that it was necessary to discontinue the therapy. The subcutaneous method is safe and painless, and for this reason was chosen for the series reported.

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For a more complete bibliography on this subject the reader is referred to the above article by Dr. M. Vele.

NOTES, CASES, INSTRUMENTS

AN ADAPTATION OF GUTHRIE'S PHYSIOLOGICAL LENSLESS SPECTACLES*

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C. C. Guthrie, in a recent article, gave a new application of the principle of pinhole vision.† In the case here reported this principle was successfully applied.

J. H., a white man, aged 40 years, was injured the night of September 29, 1934, either by a blow from an unknown assailant or by a fall. His glasses were shattered, causing lacerations of the right eyelids and right globe. The man appeared for treatment two days later in the eye clinic of the Mercy Hospital, Pittsburgh, Pa.

Examination showed visual acuity of the right eye to be light perception, of the left eye 20/200+1. The right globe showed marked injection of the ciliary vessels. There was a diagonal penetrating laceration of the cornea extending from the limbus at the 10-o'clock to the limbus at the 6-o'clock position. The corneal wound edges were in approximation. Hyphema entirely filled the anterior chamber, opaque lens substance showing nasally against the posterior surface of the cornea. Tension of the globe was definitely lower than normal.

The patient was admitted to Mercy Hospital. Atropine two percent was instilled, and a monocular dressing with bandage applied. The dressing was changed daily. Eight days after admission the hyphema had largely become absorbed. No iris tissue could be found unless possibly a minute fragment inferiorly. The crystalline lens was dislocated into the anterior chamber nasally and was completely cataractous.

Photophobia was severe and injection of the globe quite pronounced. Two weeks after admission, hot fomentations with instillations of atropine and dionin every four hours were instituted. The reaction became lessened after four weeks, although at one time enucleation of the globe had been considered. The patient was discharged from the hospital on November 8, 1934, with slight injection of the right globe. A partially absorbed traumatic cataract permitted a faint retinal reflex to be seen. The left eye was amblyopic, a hypermetropic astigmatism of two diopters contributing to the visual disturbance. The vision of the left eye had always been poor, and in childhood there had been a convergent strabismus.

The traumatic cataract was slowly absorbed and irritability of the globe lessened. On January 7, 1935, lenses were prescribed as follows: O.D.+8.50 D.sph. ⊂⊃ +4.50 D.cyl.ax. 170°, vision 20/40; O.S. — .50 D.sph. ⊂⊃ +2.00 D.cyl.ax. 150°, vision 20/80; add +3.00 D.sph., O.D., for near.

The patient had marked photophobia with dazzling and diffusion of light due to the resultant corneal scar and traumatic aniridia, as noted in the photograph. A less dense horizontal scar 6.5 mm. long by 4 mm. high extended nasally from the diagonal scar; it does not show in the illustration.

The visual acuity was not sufficient to enable the patient to resume his work as a lithograph engraver. In order to restore him to his previous economic status and efficiency, recourse was had to pinhole

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* From the Eye Department, Mercy Hospital.

†Guthrie, C. C.: Physiologic lensless spectacles. Arch. of Ophth., 1934, v. 11, Feb., pp. 254-261.

vision as applied by Guthrie. Hard-rubber occluders were drilled until a satisfactory pattern and spacing for the patient were found. The final disc was then prepared as follows:

It was cut from sterling silver, 0.03 inch thick, to the exact size of the pa-

Fig. 1 (Rhodes). Corneal scar, aniridia, aphakia.

tient's lens and was heated and molded on the surfacing tool to the exact inside curves of the lens, so as to insure a snug fit. Holes were drilled 4 mm. apart (center to center), graduated in size from the central group, which were 2 mm. in diameter, down to those on the outer edge, which were approximately .75 mm. in diameter. The center hole was set exactly over the optical center of the lens. Each row of holes was staggered. The slot over the bifocal was 2 mm. in height and 12 mm. long. As the bifocal segment had been decentered to conform with the nearpoint convergence, this slot was also decentered 1.5 mm. Hooks were attached to hold the disc firmly against the lens, one hooking over the endpiece and the other over the bridge arm. The completed disc was then oxidized a dead black, to cut down reflections.

April 12, 1935, the correction of the right eye was changed to +9.50 D.sph. ⌯ +3.00 D.cyl.ax. 175°, vision 20/30 (with pin-hole disc = 20/20+) add +2.75 D.sph. for near. Using this correction with the central disc, the patient has carried on his exacting work as a lithograph engraver for 1½ years.

Conclusions

1. The case reported is one of a scarred cornea, complete aniridia, and aphakia, resulting from a penetrating wound.

2. The patient's left eye is partially amblyopic.

3. To make it possible for him to resume his former occupation of lithograph engraving, a disc, perforated with multiple pinholes and a horizontal slot, was employed in addition to a cataract lens.

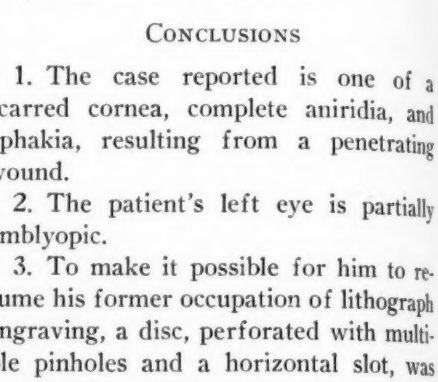

Fig. 2 (Rhodes). Pattern of perforated disc.

4. This patient has been restored to his previous economic status and efficiency.

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THE MEASURED CORRECTION OF SQUINT*

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AND
Charles E. Walker, Jr., M.D.
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Seven years ago an operation for the measured correction of squint by combined technique was reported.[1] Since the

* Read at the Summer Course of Postgraduate Instruction in Ophthalmology in Denver, July, 1936.

publication of the first paper, a larger experience has caused the author to revise slightly the measurements and procedure previously discussed. As a routine, the amount of convergence is measured in arc degrees upon the perimeter. The measurements are taken for both distance and near, with and without glasses. A thorough study of the case, as suggested by Jameson[2] and White,[3] is carefully conducted. Ether has been the anesthetic of choice in patients under twenty-five years of age, for with novocaine it is seldom possible to anesthetize completely the muscles involved in the operation. The eye is prepared for the surgical procedure by clipping the lashes, scrubbing the face with soap and water, painting the face and lids with 2-percent iodine followed by 95-percent alcohol. An incision is made over the insertion of the external-rectus muscle (in cases of convergent squint). The muscle is then isolated from the surrounding capsule and the check ligaments are severed. A tuck of a given amount is taken in the muscle by passing a needle through the double muscle belly on each side of the upright of the improved Bishop tucker, and tied above and below. It is unwise to pass the needle below the tucker as there is danger of piercing the sclera. The suture used at present is 000 atraumatic catgut with needle attached supplied by Davis and Geck. The catgut is absorbed in about ten days. Number-eight white silk has also been used and found to be quite satisfactory. The conjunctiva is then closed with a running suture of fine black silk.

As also advocated in the previous paper, Todd's[4] tendo-muscle lengthening is used. After the muscle is fully exposed a double-bladed muscle-fixation forceps is clamped on the muscle close to its attachment. The first cut is made in the tendon from above downward, three fourths of the muscle being cut. The next cut is made between the blades of the forceps from below upward, again cutting three fourths of the muscle, and the third cut is from above downward next to the outer blade, the same distance as the first cut. The forceps is removed and the conjunctiva closed in the same manner used for the external closure. It is interesting to note that in the British Journal of Ophthalmology for May, 1935, Dr. W. B. I. Pollock reports that he has used the tendo-muscle-lengthening of Bishop Harmon for the past eleven years.

A preference for the subconjunctival tenotomy of the internal rectus, advocated by Parker,[5] is justifiable. Nineteen unselected, consecutive patients were operated on by this method. Of the group, two had slight divergence with glasses, and some limitation of internal rotation. The entire group was satisfactory from a cosmetic standpoint. A small series with central tenotomies did not give satisfactory results. During the past few years recession operations have been advocated by Jameson,[2] Berens, Losey, and Connolly,[6] Peter,[7] Wilkinson,[8] and others. Scleral stitches as a routine practice should be avoided. Their disadvantages have been discussed in the previous paper. Recession is too fixed a procedure, allowing no latitude for stabilization.

In order to determine the amount of tuck necessary to correct a given squint, it is easier to demonstrate by a definite example. We shall take a 30-degree squint, which is the greatest deviation found in the measurement on the perimeter. We first divide the arc degrees by three, as it has been our experience that three arc degrees of squint equals one millimeter of shortening. To this we add five millimeters to allow for stretching and to allow for sufficient tension on the opposing muscle when lengthened. This would give us a total of fifteen (ten plus

five) millimeters to shorten. When the tuck is made, of course it would be a tuck of seven-and-one-half millimeters. To reduce this to a mathematical formula we have:

$$\frac{\text{arc degrees of squint}}{3} + 5 = \frac{\text{tuck}}{2}$$

The same measurements have been found satisfactory for the correction of divergent squint, although in divergent squint the authors always tenotomize the external rectus.

Previously both eyes were bandaged for five days, but now we find it better to bandage the eye that has been operated on only, after the first day, for the movement of the unoperated-on eye tends to hold the edges of the cut apart and gives a more satisfactory recession.

SUMMARY

1. Careful study and measurements should be completed before operation.

2. Both muscles are exposed.

3. In determining the amount of tucking for the external rectus, divide the arc degrees by three (one millimeter shortening for each three arc degrees) and add five (the allowance for stretching).

4. No change in measurements is made for a divergent squint, but a tenotomy of the external rectus is performed.

5. Tendo-muscle lengthening and subconjunctival tenotomy both give satisfactory results.

6. In resection divide by three, but make no allowance for stretching.

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SOCIETY PROCEEDINGS

Edited by Dr. H. Rommel Hildreth

MINNESOTA ACADEMY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY

Section on Ophthalmology
October 16, 1936

Dr. William L. Benedict, *president*

The prevention of blindness

Dr. Harry S. Gradle, Chicago, said that with the remedial measures now available it was estimated that approximately 70 percent of the present existing blindness could be eliminated without difficulty within the next generation. The coöperative endeavors of governmental, state, educational, and lay agencies were necessary in such preventive work.

Discussion. Dr. Frank E. Burch, St. Paul, said that prevention of blindness in Minnesota is far behind schedule as compared with Illinois. However, as a basis for possible prevention work in this field in the future, the Eye Department of the University of Minnesota has endeavored to obtain a census of the blind in this state. Dr. Charles Stanford, who is collecting the necessary data, has had fine coöperation from Mr. M. I. Tynan and the State Board of Control, from Mr. Lysen and Dr. Gammell of the School for the Blind, and from the directors of hygiene in the public schools. So far the results of the analysis of the census are very incomplete, as the work has only been started. The number of applicants for blind pensions is rapidly increasing. Unfortunately many of the diagnoses are uncertain and incomplete. Dr. Burch said Dr. Stanford would call upon the Academy members to verify the diagnosis in some cases and he hoped they would cooperate and give him any data they have in their follow-up records to make classification more accurate. He stated that they had in training for the University a social worker who, it is hoped, will be a great help in getting data on follow-up of University cases. He commented upon birth control as a possibility in eliminating some of the causes of congenital and hereditary blindness, which constistutes a much larger class than one had been led to believe. He also stressed the importance of venereal prevention work, the recognition and control of syphilis, education of the public in accident prevention, and the necessity of publicity regarding all types of preventive measures. This attempt to classify cases had been undertaken partly from academic and sociologic interest, as well as to ascertain a proper basis for preventive work. Dr. Burch said something may eventually be accomplished by the census work, so that future lay organizations may realize just what can be done in the way of prevention.

Dr. Lawrence T. Post, St. Louis, said that this work in Missouri has been carried on quite efficiently for many years and that Missouri was the first state to have accurate figures on the causes of blindness. Dr. H. D. Lamb had published these figures some years ago. Dr. Post said that there were about 3,000 cases of total blindness in Missouri. There was a pension system administered by an agency somewhat similar to that described by Dr. Gradle. It had been found to work very satisfactorily. Administering the pensions in Missouri presented just such problems as Dr. Gradle described. Many old people preferred a pension and blindness to an operation and sight. If over seventy years, they could choose. The small amount of money they got was enough for them to live on, and also for their family. Five or six could live quite

adequately on this small pension in the mountain districts from which many of them came. If doctors backed the work in all its phases, much could be done to reduce the incidence of blindness.

Walter E. Camp,
Secretary.

PITTSBURGH OPHTHALMOLOGICAL SOCIETY

October 19, 1936

Dr. G. E. Curry, *president*

Angiomatosis retinae

Dr. D. H. Rhodes presented a white boy, aged 15 years, who was first examined August 12, 1936. The patient's right eye had been blind ever since he had been struck with a piece of slate at the age of five years. He had noticed a gradual reduction in the visual acuity of the left eye, in the past three years, more rapid in the past eight months. The patient's general health was otherwise normal. The family history was negative as to visual impairment: father, mother, three brothers, and one sister were living and well.

There was an old scar in the center of the right eyebrow. The right eye was divergent about 20 degrees; the pupil was small and slightly funnel shaped. The crystalline lens was yellowish-white in color and no fundus reflex was obtainable. The tension of the globe was a low normal as tested by palpation. There was no light perception.

The left eye was normal externally. The vitreous contained a number of opacities. The optic disc margins were lost in the general exudation and edema of the retina. The retinal veins appeared to be at least four times their normal size, were extremely tortuous, and, well to the periphery, were lost in reddish areas (so-called lakes of blood). The retinal arteries were about a third smaller than the veins and were likewise very tortuous. The superior nasal branches appeared not to participate in the process. Grayish-white mottled patches were lying temporal to the disc, while in the lower nasal portion of the retina, a massive white-sheet exudate was noted, the retinal vessels, for the most part, overlying this. In the periphery, temporally, the retina gave the appearance of being detached in spots. Vision was 20/80.

The patient was admitted to Mercy Hospital for a complete medical survey. General physical examination was negative. The otolaryngologist reported a slight obstruction of the left nostril due to a thickened and deviated septum; slight cloudiness of the left antrum and chronic tonsillitis. Neurological examination, with especial reference to the possibility of Lindau's disease, was entirely negative.

Laboratory findings were within normal limits. An X-ray film of the right eye was negative for foreign body and a roentgenograph of the chest showed no diagnostic lesion of tuberculosis.

Discussion. Dr. H. H. Turner gave a detailed résumé of Von Hippel's work on angiomatosa retinae. He stated that no treatment was of any avail and criticized Bedell's statement in "The eye and its diseases" by Berens that "Radium or X-ray treatment seems to have a beneficial effect but that the dosage of the rays to the eyeball must be accurate," because he cannot conceive that these rays could be employed in sufficient quantity to affect the lesion without destroying the function of the globe at the same time.

Dr. Adolph Krebs, who had also seen the patient in consultation with Dr. Rhodes, stated that clinical diagnosis could be arrived at only by exclusion. He displayed his own colored illustrations of a case of angiomatosa retinae which pre-

sented some of the features seen in this case.

Murray F. McCaslin,
Reporter.

COLLEGE OF PHYSICIANS OF PHILADELPHIA

Section on Ophthalmology

October 15, 1936

Dr. Charles R. Heed, *Chairman*

Suspected neoplasm of the choroid

Dr. William J. Harrison presented Miss J. B., aged 22 years, a seamstress, who had first noticed loss of vision in the right eye three months previously. Vision in the right eye was 10/200; the pupil, 3 mm. in diameter was round and reacted directly and consensually to light. Tension was 22 mm. Hg. There was a loss of the upper half of the perimetric field. A retinal detachment occupied an area between the 6- and 9-o'clock position and extended almost to the ora serrata, with surrounding pigmentary changes in the choroid and some macular involvement. The optic-nerve head was of good color. Transillumination showed some interference with the path of light over the area embraced by the retinal detachment. Dr. Harrison said that the diagnosis of suspected early neoplasm is based on the clinical findings of retinal detachment, interference with the transilluminating beam of light, the pigmentary disturbances of the surrounding fundus, and the absence of vitreous opacities and deposits on the posterior layer of the cornea.

Discussion. Dr. William Zentmayer said that he had seen Dr. Harrison's patient on two former occasions and in the interval some change had taken place in the ophthalmoscopic appearance. There was some elevation in the anterior central part and a wider separation of the retina. Transillumination showed diminution of the transmitted light. In the absence of a history of trauma in a nonmyopic eye having no precipitates on the posterior surface of the cornea and with the present symptoms he believed that Dr. Harrison was justified in a provisional diagnosis of tumor of the choroid.

Dr. Charles W. LeFever said that in view of the widespread detachment, and in the absence of any smooth, rounded area, he did not believe there was a tumor behind the retina. The entire field of detachment was in convolutions. Widespread detachment of the retina does not occur early in sarcoma of the choroid. If a growth were present it must be of the flat type.

Dr. H. Maxwell Langdon was reminded of a similar case seen at the University Hospital 20 years ago, in which there was a question as to whether there was a growth or a simple detachment with subretinal hemorrhage. Transillumination showed a definite loss of light. The patient submitted to operation and the eye was removed. Sections were made of the eye and the first sections showed nothing but a hemorrhage, according to the pathologist. Later sections showed first just the tip of a growth, which proved to be a well-developed sarcoma, the hemorrhage overlying the real growth.

Dr. Leighton F. Appleman had seen a patient in the early stages of this sort of tumor. The detachment had a distinctly elevated appearance, was rather dark, and very typical of solid growth. Within a week or ten days the entire vitreous, which previously had been clear, became clouded and much of the fundus was obscured. The vision was reduced to light perception. There had been no increase of tension and his impression was that a subchoroidal hemorrhage had ballooned the retinal and choroidal layers. Later, diffusion and inflammatory

changes occurred, and the vitreous became typically dark and cloudy.

Acute retrobulbar neuritis secondary to ethmoidal infection

Drs. James H. Babbitt and H. Maxwell Langdon said that the question whether retrobulbar neuritis can result from infection of the paranasal sinuses is so debatable that some physicians deny that this ever happens. Undoubtedly most of the cases arise from other causes; the present case, however, seemed to offer evidence that sinus disease was the cause of the retrobulbar inflammation of the patient's right eye.

A man, 54 years of age, had had transient attacks of loss of vision of the right eye, lasting from five to ten seconds and always while driving a motor car. The attacks had occurred for about three years.

Nasal examination showed polypoid degeneration of both middle turbinates; an irregular septum with large perforation; faucial tonsils small and buried, but suggesting low-grade chronic sepsis. There had been intranasal maxillary drainage on both sides. The X-ray report from Dr. Pfahler showed frontal and sphenoid sinuses healthy and clear; ethmoid cells diseased on both sides; and in the right maxillary sinus, a slight thickening of the outer wall as from hyperplastic sinusitis.

In October, 1934, the patient awoke one morning, to find the vision of the right eye completely gone, although it had been normal on retiring. This lasted for three days and then began to clear with a complete return of central vision to normal but a loss of the upper nasal field. There were no fundus changes except for some irregularity of the caliber of the inferior temporal retinal artery. The diagnosis was either embolism or spasm of the artery, the latter seeming the more probable diagnosis.

Eighteen months later an acute exacerbation of the sinus disease occurred. Dr. Pfahler reported that the X-ray film showed the right frontal sinus slightly opaque; sphenoid sinuses relatively clear; ethmoid sinuses extensively clouded by hyperplastic thickening of mucous membrane; right maxillary antrum almost entirely opaque and left antrum partially opaque, probably from much-thickened mucous membrane.

On the morning of April 3, 1936, the right vision became blurred without other symptoms; examination showed that the vision was 5/60 and the pupil dilated and sluggish in its reaction to light. The vision of the left eye was 5/4 and the pupil normal; there was no fundus change other than in the retinal artery of the right eye as previously described. The field of the right eye showed a marked increase of the nasal loss and a very definite central absolute scotoma. The diagnosis of an acute retrobulbar neuritis was made and on the following day the ethmoid sinuses were operated on.

A general physical examination by Dr. Pfromm elicited no condition that could be associated with ocular neuritis. In a week vision began to improve and in two weeks had become 5/22. There is still a slight relative central scotoma but with slow reading, vision is normal.

The connection between the ocular disease and the disease of the sinus appeared to be so close that it seemed this case should be put on record.

Pathogenesis of unilateral exophthalmos

Dr. Edmund B. Spaeth presented a paper on this subject which will be published in the Archives of Ophthalmology.

Discussion. Dr. W. E. Fry said that Dr. O'Brien and Dr. Leinfelder in a recent paper had summarized 82 cases under their observation, and of these about 50 percent were due to malignant diseases of the orbit. In their group of cases the

one most important cause of all cases of unilateral exophthalmos was malignant tumor of one type or another. Unilateral exophthalmos that occurs with goiter is interesting. Some doubt the importance of Müller's muscle in producing exophthalmos because of the fact that this is a microscopic structure and would not have great functional importance in men.

Preliminary report on fifteen cases of retinoblastoma

Dr. Joseph Waldman said that the reason for consulting the ophthalmologist in every case was the so-called cat's-eye reflex. The average age of patients was 3½ years. As to sex, there were six males and nine females; as to color, 14 were white, and one colored. It is extremely rare in colored children, even in districts of the country where the colored population is very high. Five of the patients are living, ten have died. The longest duration of life is in one patient, operated on in 1925. Of the other living patients, one was operated on in 1927, one in 1929, and two in 1933. The left eye was involved in five, the right eye in eight, and the condition was bilateral in two.

The types were differentiated by silver stains into (1) medullo-epithelioma, (2) retinoblastoma (containing pseudo-rosettes), (3) neuro-epithelioma (containing true rosettes). All three types merely represent various stages in the morphogenesis of embryonic retinal cells.

The principal point stressed in the treatment was a plea for the removal of much larger sections of optic nerve in performing the enucleation, as much as 10 to 12 mm. was suggested. The average length of optic nerve seen in the laboratory was three to four millimeters. Dr. Waldman also urged immediate examination of nerve tissue for evidence of extension.

Discussion. Dr. William Zentmayer said that it had been suggested and he believed was carried out by Dandy, that a transfrontal operation be performed, the optic nerve being removed as far back as to the chiasm, in all cases of glioma of the retina, because of the frequency with which the optic nerve has been found to be involved behind the section made in enucleating the eye.

A. G. Fewell,
Clerk

CHICAGO OPHTHALMOLOGICAL SOCIETY

October 19, 1936

Dr. G. H. Mundt, *president*

Glaucoma following cataract

Dr. Thomas D. Allen presented a man who had been examined first by Dr. Wilder in 1894, when he gave a history of having been short-sighted for 10 years. At that time vision was as follows: R.E. 20/80 with —18.00 D.sph. ⌯ —1.50 D.cyl.ax. 170°; L.E. 20/50 with —18.00 D.sph. ⌯ —2.00 D.cyl.ax. 20°. In the right eye there was a large posterior staphyloma with changes around the macula; a large posterior staphyloma in the left eye was stationary.

Since 1922 he had been a rather constant patient. At this time, at 49 years of age, he had had diabetes for 22 years but had never used insulin. The myopia had increased in each eye. There were increased changes around the posterior pole, and many large and small floating vitreous opacities. The vision of the right eye was reduced to 20/200; of the left to 20/120, with occasional slight improvement. The lenses became slowly more and more sclerotic. A contact glass was unsatisfactory, as were also telescopic spectacles.

About 20 months previously an iridectomy and later an extracapsular opera-

tion had been performed with no ocular complications. Vision improved to 20/100 with a —4.00 D.cyl.ax. 112°. There was a very interesting extension of the myopic changes which seemed to cut the macula in two, so that in mapping out the central fields a wedge-shaped area of visibility extended upward about half way through the fixation point. The fields were so small and the left vision had become so reduced that an operation was decided upon for the left eye.

Dr. Wilder had suggested after the operation on the right eye that a round-pupil extraction be performed on the left, preferably in the capsule, so as to avoid the severe photophobia that followed the operation in the right eye. Such an operation was performed on August 18th. In this eye, as in the right, on making the corneal section the cornea collapsed. There were no complications. The anterior chamber re-formed within 24 hours, the conjunctival suture was removed on the fourth day, and the patient was discharged on the tenth day.

Three days later the anterior chamber was abolished. Vision was ability to count fingers at eight feet. There was excellent projection, the pupil was 4.5 mm. round, without synechiae. There was no choroidal detachment, nor evidence of leakage of aqueous by the fluorescein test. Tension was R.E. 11 mm., and L.E. 20 mm. Two days later tension in the left eye rose to 65 mm. The patient was taken to the hospital where leeches were applied and eserine was instilled every hour. Dr. Brawley saw him five days after the anterior chamber was first found abolished and urged immediate deep-root iridectomy. As soon as the anterior chamber was entered so that some aqueous could escape, the iris again assumed its normal position, but a large deep-root iridectomy was performed.

There has been no subsequent rise in tension and the inflammatory reaction has been gradually subsiding. The opacities in the vitreous interfere with clear visibility of the fundus. However, no detachment of the retina seems to be present and there is a very evident wide extension of the changes in the posterior pole involving the macula.

No explanation has been advanced for the abolition of the anterior chamber between the tenth and thirteenth days. It is possible that the patient wiped the eye and pressed too hard, thus causing a sudden gush of aqueous and adherence of the iris to the cornea. The vitreous was known to have been for the most part fluid, and it is barely possible that what aqueous was subsequently formed escaped posteriorly through the thickened layer of anterior vitreous. This aqueous pressed against the thickened vitreous which, in turn, pressed against the iris, which was lying against the cornea.

Dr. Karl Lindner, when lecturing here last year, reported some experiments in producing vitreous fistulae on rabbits. The immediate result, which lasted for several days, was a very deep anterior chamber. On being questioned concerning this case Dr. Lindner replied that he would have performed a vitreous fistula; that if the area where the fistula is to be put is electrocoagulated, there is no danger of retinal detachment, and the fistula prevents the formation of anterior synechiae. However, Professor Imre, the guest of the Society this evening, suggested that vitreous fistula is still in the experimental stage and that a better result by any method could not have been obtained in this case.

The patient today has vision R.E. 20/200+ which probably can be improved when a needling has been performed on the secondary cataract; in the left eye, vision is ability to detect hand movements.

HOLE IN THE MACULA

DR. R. KOPF presented a 47-year-old colored woman who had come to the Michael Reese dispensary with a history of slowly progressive loss of vision during the past seven years. Vision for close objects was fairly good and she could read without difficulty. Vision was R.E. 20/200, not improved with correction; L.E. 20/100, improved to 20/20 with —2.00 D.sph. ⊂⊃ —0.50 D.cyl.

Fundus examination showed a perfectly round, punched-out lesion in the right macula, one-half D.D., with a red base. For one D.D. surrounding the hole was an area of black indistinct pigment. There were several whitish dots in and just beyond the pigmented ring. There were no other significant objective findings in a complete eye examination. Peripheral fields showed marked contraction of the right field down to about 30 degrees on all sides of the fixation point. The left peripheral field showed a less marked concentric contraction of about 20 degrees. Central fields showed a large central scotoma of the right eye about 12 to 15 degrees in diameter, and a very large irregular cecal scotoma about 15 to 20 degrees in diameter, just temporal to the central scotoma. The left eye showed a slight enlargement of the blind spot.

There was no history of trauma to the eyeball. The general physical examination was negative for pathology. There was a history of three miscarriages, all at about six months. Two years before admission, the patient had had an attack of what she termed neuritis and lumbago, of which no further details were available. There is now a leukopenia of 3500 to 5500, with a relative lymphocytosis varying from 50 to 70 percent. There is apparently no explanation for the contracted peripheral fields in both eyes and the enlarged blind spot in the left eye.

Discussion. Dr. M. L. Folk said there were two interesting features: first, the peculiar field, which cannot be explained by the pathology found in the fundus; second, the etiologic factor. The etiology of macular holes is due to inflammatory processes in the eye, such as iridocyclitis, and to degenerative processes, such as retinitis, choroiditis, or trauma. Since there is no evidence of degenerative nor inflammatory processes in the eye, we must assume that the basis was trauma of such mild nature that the patient was not aware of it.

RETINAL DETACHMENT

PROFESSOR JOSEPH IMRE, of the City Hospital, Budapest, said that of foremost importance in the treatment of detachment of the retina is a good fundus picture with the tear well localized. In his series of 167 cases the hole was found in 153, and this was in a measure unquestionably due to the excellent work of the artist. Of course in some cases it is impossible to find the hole even after a search of several days, and here the results are much more problematic. Nearly all the pictures show fine strands of vitreous extending from the tear to the periphery, and it would seem that there is some connection between this condition of the vitreous and the retinal tear. While some authorities contend that these vitreous changes have no bearing on the retinal detachment, it is at least a coincidence that they occur together so frequently.

Diathermy is very popular but some find electrolysis much more simple, since it does not require such precise technique for the localization of the retinal hole. It can be used with either the positive or the negative electrode. The electrocautery is useful in the occasional case in which, unless a great part of the retina is sacrificed, diathermy or electrolysis will not produce sufficient adhesion, and it is

necessary to combine some of these more modern methods with the electrocautery to obtain a good result. The undermining operation of Lindner appears to sacrifice the most valuable part of the retina and therefore there can be no return of function.

When may a case be considered cured? Gonin thought if six weeks elapsed without redetachment the patient was cured. If there was a new detachment after that time he considered it a new case. It must be realized that such a retina is like a piece of old brocade; it may be mended in one place, but the entire structure is frail, and the same condition, a senile change or a presenile cystic degeneration, may cause recurrence elsewhere. If, therefore, the attached retina has remained in place for three months, and a new tear occurs, unless it really has some connection with the first, or is the result of an imperfect closing of the old tear, the case may be considered a new one.

Statistics on operative reattachment have been given, some recording 90 percent cures; but statistics have little value in these cases. If statistics are to be of any value no discrimination as to the type of case in which operation is performed should be made. If a case is not included because the detachment is too old, or the tear is too large or unfavorably located, and the statistics are compiled from the remainder of the series, a high percentage of healing may be shown. The best results are obtained in patients between the ages of 20 and 40 years; from 40 to 50 years there is not a conspicuous difference, but from then on the prognosis is much worse. Of course, older patients, because of their general condition, cannot be operated on repeatedly. In the series reported tonight, in which no selection of cases was made, there was about 56 percent healing—but these patients were really cured. Retinal detachments which are seen and operated on within the first two weeks after the detachment occurs offer the best results, cures in 74 percent of cases. For a time the percentage was over 80, but a series of very unfavorable cases lowered this. The patients in this series who were operated on within two months of the detachment obtained cures in 60 percent of the cases; within six months, 52 percent; above one year about 32 percent. The last figure, however, is not reliable, for not many of such cases are seen. Robert von der Heydt.

ERRATUM

The reference to Dr. William H. Crisp's paper on the cross-cylinder tests as given on page 410 of the April issue is incorrect. This paper was read before the Oxford Congress and appeared in the Transactions of the Ophthalmological Society of the United Kingdom, 1931, volume 51, page 495. It also appeared in the American Journal of Ophthalmology, 1932, volume 15, page 729.

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THE AMERICAN BOARD OF OPHTHALMOLOGY

The history of the American Board of Ophthalmology, now completing its twenty-first year of existence, is something of which the ophthalmologic profession of the United States has much reason to be proud. It is a product of democratic and voluntary organization, an outgrowth of conservative yet flexible types of representation. The Board has made a great contribution to raising of the standards of training in ophthalmology, and it has been the modest pioneer in the creation of similar boards in various lines of special medical practice.

Since the movement toward advancement of standards in the medical specialties is entering upon a new phase in which the American Medical Association, the largest medical organization in the world, is destined to play a prominent part, it may be worth while to review here* some of the salient facts as to the inception and development of the American Board of Ophthalmology.

In 1913, on the initiative of a small group of educators, committees were appointed by the American Ophthalmological Society, the Section on Ophthalmology of the American Medical Association, and the American Academy of Ophthalmology and Otolaryngology, for the purpose of conferring and reporting on ophthalmic education.

In 1914 these committees recommended that graduate courses in ophthalmology leading to an appropriate degree should be established by first-class medical schools, such courses to represent not less

*From a report recently presented to the American Board of Ophthalmology.

than two years of systematic work after the degree of Doctor of Medicine had been conferred. The committees realized that the number of those who in the near future would take these complete courses leading to a degree would be small, while on the other hand such courses could not solve the problem of differentiating between the competent and incompetent among those who were then practicing ophthalmology.

In 1915 the committees made further recommendations aimed at the appointment of a joint board consisting of three representatives from each of the three special societies. After much preliminary work, this board was organized in 1916 as the "American Board for Ophthalmic Examinations." The Board was incorporated in May, 1917. A few years ago its name was changed to "American Board of Ophthalmology" for the sake of uniformity with the names of other special examining boards. In 1934 the Board was enlarged by election of four members instead of three from each constituent society. One member is elected each year by each society, to serve for four years, and no member of the Board may serve for two consecutive full terms from the same constituent society.

The American Board of Ophthalmology states as its principal functions the establishment of standards of fitness for the practice of ophthalmology, the conducting of examinations and the issuance of certificates as to qualification, and the guidance of prospective students of ophthalmology.

Many special eye hospitals as well as a number of general hospitals in all parts of the country make the certificate of the American Board of Ophthalmology a condition for appointment or promotion on their staffs; and a number of national and local societies require the certificate as a condition for membership. Up to the beginning of the present year, 1,365 ophthalmologists had received this Board's certificate.

In course of time it became evident that some sort of coördination might with advantage be established between the activities and standards of the different examining boards; and in 1933 the American Medical Association authorized the Council on Medical Education and Hospitals to formulate standards upon the basis of which new examining boards might be recognized. The Advisory Board for Medical Specialties was organized in 1934 to give effect to these purposes. It is composed of representatives of the examining boards and of the Association of American Medical Colleges, the American Hospital Association, the Federation of State Medical Boards of the U.S.A., and the National Board of Medical Examiners. The Advisory Board reports to and functions in conjunction with the Council on Medical Education and Hospitals of the American Medical Association.

Just as has occurred with the standards for the practice of general medicine, so it is natural that the standards for practice of ophthalmology and other medical specialties should gradually become stricter and more comprehensive. It is already evident that the creation of the Advisory Board for Medical Specialties will contribute materially to this end, although it has to be recognized that no identity of standards can exist as between such widely varying specialties as ophthalmology, laryngology, obstetrics, and dermatology—to mention a few among the various boards which have already been created.

It appears probable that after 1938 no physician will be registered in the Registry of Specialists of the American Medical Association unless he holds the certificate of the appropriate examining

board. The Advisory Board for Medical Specialties is disposed to set up a minimum of five years training before certificates can be granted. In a recent paper (Archives of Ophthalmology, 1937, volume 17, page 399), Lancaster has pointed out the difficulties associated with excessively hasty and enthusiastic attempts at advanced standardization. He points out that at the present time there are probably not less than 500 physicians who are preparing themselves for the practice of ophthalmology, whereas in the length and breadth of the United States there are not more than three institutions which can offer complete training such as would meet the requirements of the Advisory Board for Medical Specialties. "To set up and insist on a requirement which there is no provision to meet is futile, irrational and stupid."

Realizing that those who contemplate the practice of ophthalmology often experience difficulty in obtaining satisfactory guidance with regard to the pursuit of their studies, the American Board of Ophthalmology has recently laid plans for creation of a Preparatory Group of prospective candidates for its certificate.† Both graduates and undergraduates of approved medical schools are eligible for membership in this group, and those whose applications are accepted will be furnished with various information, including syllabuses of study and advice as to textbooks. Members of the Preparatory Group will be required to keep a summarized record of their activities from year to year, such record to be incorporated in the final application for examination and certification.

W. H. Crisp.

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†Those who desire to register with this Preparatory Group should communicate with the Secretary of the American Board of Ophthalmology, Dr. John Green, 3720 Washington Boulevard, Saint Louis.

A RESOURCE FOR VISION

The nautilus, belonging to an ancient type of animal life, has an eye that consists of a cup, lined with retina, to which light is admitted through a small opening. This permits the light from one object to make an impression on only one part of the retina, so that each part of the retina receives the impression of only one object. Euclid and Aristotle understood that in a dark room or dark box, light admitted only through a small hole would give a picture of objects outside in a strong light. This kind of dark room (Latin, camera obscura) was used by magicians and charlatans of the Middle Ages to interest and astonish their followers. For this purpose the effect was increased by placing a convex lens in front of the opening.

From this has developed the photographic camera of today. Without any lens but with a strong light, a very small aperture, and by means of a long exposure quite good photographs may be obtained in this way. With the usual photographic lens, the small aperture and long exposures give photographs of deep objects; such as the eye in a deep socket, or an exophthalmos, where one part will have a very different focus from another. Kepler, in about the year 1600, explained that the eye is a camera obscura. The improved vision obtained with a contracted pupil is thus explained, and this accounts in part for the better vision we have with strong light.

Heretofore, we have not taken full advantage of this principle, as we learn from the article by Dr. D. H. Rhodes, published in this number of the Journal. Stenopaic spectacles have been described and used before, but not with the brilliant results achieved in this case. To know that such results are possible is a new resource for giving patients better vision. The Esquimaux, Indians, and

others dwelling in the Far North have used wooden spectacles with a hole or slit to protect their eyes from the reflection of bright sunlight on the snow, and thus get better vision in the arctic regions. But the great gain of vision possible with a wider field of vision, by using multiple small apertures, has never received such a practical demonstration.

Working from the side of physiologic optics, Prof. Guthrie had demonstrated the possibility of such an apparatus to improve vision; and Dr. Rhodes has demonstrated that it may make the difference between economic blindness and good useful vision with economic independence. An appreciation of what this may mean to some patient should be in the mind of every practical ophthalmologist.

It might be thought that multiple apertures would cause multiple images and monocular diplopia. But with apertures of proper size, placed at appropriate distances, this trouble will not occur. The different images formed on the retina should be of different objects, in different parts of the field of vision. In good light, they need cause no serious confusion to one who has become accustomed to working with them. In general, to apply this new resource there must be careful study of each eye and of the needs of the individual patient. It has been suggested that such apparatus might, in some cases, replace the common use of lenses. But the cases in which this would be possible will be very few, if the comparison is made with lenses carefully chosen by the best practical methods.

There is one class of patients, the albinos, for whom it has heretofore not been possible to do very much. Most albinos have rather high errors of refraction. But the worst defect of such eyes is the absence of pigment, which permits an excess of light to enter the eye through the choroid, sclera, and lids. The shutting out of the light with the assistance of substituting a small aperture for the unpigmented iris and pupil may be a positive boon to such patients. The plan of using a silver plate blackened by oxidation seems a very practical suggestion that can be applied to the benefit of albinos. It is to be hoped that careful studies and experiments will be made in this direction. The best general definition of glare is, light entering the eye that does not help in vision. This new resource applied in the manner shown, to meet best the needs of the individual case, will be a great advance over the widely advertised expedients to reduce glare.

Edward Jackson.

"VOORKOMING VAN BLINDHEID"

The University of Leiden, one of the most famous institutions in the world, was founded by the Prince of Orange in recognition of the great bravery of the Burghers in resisting the Spaniards in the siege of the year 1574. The 362d anniversary of the founding of this ancient seat of learning was celebrated on February 8th of the present year, and an address with the above title was given by the Rector Magnificus Professor van der Hoeve.

At a time when America was little more than a wilderness and was still largely in possession of the Indians, the Dutch were already people of advanced culture. The address made on this occasion is one of special interest to American ophthalmologists. The president of the 13th International Ophthalmological Congress, who is also the present rector, is well known in this country. In 1921, Dr. van der Hoeve was guest of the American Academy of Ophthalmology and Otolaryngology at the meeting in Philadelphia. From the university of which he is

the head have come some of the most famous men in history, literature, science, and the arts. They include such names as Scaliger, Grotius, Arminius, Boerhaave, Hemsterhius, and many others. Leiden always has been an academic rather than a commercial city. Princess Julianna was a student there.

An official address, therefore, is one of great importance, and it is significant at the present time that its title as given above, "The Prevention of Blindness,"* should have been chosen. Van der Hoeve is one of the most forward looking ophthalmologists in the world. At the close of the International Ophthalmological Congress held in Scheveningen, he called together a group of representatives from various countries, and there was formed the International Association for the Prevention of Blindness under the presidency of de Lapersonne of l'Hôtel Dieu of Paris and also the International League for the Control of Trachoma under the leadership of de Grósz of Budapest. The latter organization is now headed by Mac Callan, so well known for his work in Egypt.

Preventive measures occupied a leading position on the program of the International Ophthalmological Congress held in Madrid in 1933. It will take an equally important place on the program of the International Ophthalmological Congress to be held at Cairo in December of the present year.

The opening papers will be read by Bailliart, a member of the International Council, and representatives of the (American) "National Society for the Prevention of Blindness." This places prophylaxis among the obligations of ophthalmology and puts it frankly on a footing with reparative and curative measures. The Congress promises to be one of great interest and many Americans are expected to attend.

Park Lewis.

*Voorkoming van Blindheid. Rede Uitgesproken op den Driehonderd twee-en-zestigsten dies Natalis der Leidsche Universiteit, 8 Februare 1937 door den Rector Magnificus J. van der Hoeve.

BOOK NOTICES

TRANSACTIONS OF THE AMERICAN OPHTHALMOLOGICAL SOCIETY, volume 34. Seventy-second annual meeting. Clothbound, 386 pages. Philadelphia, The American Ophthalmological Society, 1936.

This volume is very similar to its predecessors. It is well edited and beautifully illustrated, printed, and bound. There were losses by six deaths, two of them, Doctors Wilmer and Wilder, being among the leading ophthalmic educators in the country.

The papers presented before the session are of customary excellence; a considerable number of them will be published in this Journal and in the Archives of Ophthalmology.

The Society has always reserved for its Transactions the theses of accepted candidates for the Society. This has had the advantage to the Society of rendering its Transactions valuable, for these theses collected through the years appear in the Society's Transactions only. It has the disadvantage that the results of long and painstaking researches reach only the rather limited number who receive the publication of the organization.

In the present volume 144 pages of the 386-page volume are occupied with these theses. Our readers may be interested in some details from a few of them. Paul A. Chandler reviews Dacryocystorhinostomy, reporting 53 operations performed after Mosher's technique with 70 percent success; 25 operations following the method of Ohm-Dupuy-Dutemps-Bourguet with 80 percent success; and 22 operations performed after a new technique of anastomosing the sac and the na-

sal mucous membrane, which he describes in the article, all of which were successful. The appended bibliography contains 326 references, indicative in itself of the enormous amount of labor involved in the preparation of this thesis.

Wilfred E. Fry has an excellent technical paper on the Reticulo-endothelial system of the eye. Philip M. Lewis reviews 200 cases of epidemic cerebrospinal meningitis in which eye changes are noted in 49 percent of the cases. However, of this percentage 16 were simple engorgement of the retinal veins and 11 hyperemia of the discs and retinas. Pathological specimens from seven cases are presented. The large variations in percentages of ocular involvement quoted by this author are accounted for by the differences in the virulence of epidemics.

Angus L. MacLean presents experimental iritis. He repeated the work of Swift and his associates, confirming it and extending their observations "to show that the untraumatized uveal tract of sensitized animals also participates in this general sensitization to green streptococci, and that, as a result of such sensitization, the intoxicated untraumatized eye may show a transient uveal inflammation."

Phillips Thygeson's thesis concerned ophthalmia neonatorum, a study of 261 cases. The work was reported from the Department of Ophthalmology of the State University of Iowa. A complete discussion of the subject is presented with excellent illustrations of various associated organisms. Summarizing his more important conclusions, the conjunctivitis of the newborn infants "was caused by a limited group of bacteria, by a single virus, and probably, in a few cases, by a chemical agent—silver nitrate. The known etiologic agents, in the order of their frequency were Staphylococcus aureus, Diplococcus pneumoniae, inclusion blennorrhea virus, Diplococcus pneumoniae and Staphylococcus aureus combined, Haemophilus influenzae, Escherichia coli, Streptococcus viridans, Haemophilus influenzae and Staphylococcus aureus combined, and Neisseria gonorrhoeae. The incidence of all types together was 6.6 percent, and of gonorrheal ophthalmia, 0.022 percent." "The infecting agents in gonorrheal ophthalmia and inclusion blennorrhea were demonstrated in the cervices of the mothers of affected babies."

C. Dwight Townes chose for his subject "A statistical study of spectral hue discrimination in trichromatic and dichromatic eyes." This is another very technical paper. He summarizes his results as follows: "The hue-discrimination curve of protanopic and of deuteranopic eyes is shown to be closely similar, and to consist of a single region of low threshold centering at about 490 millimicrons, when hue alone has been isolated as a measurable variable, free from differences in intensity. It has also been shown that this low threshold at about 490 millimicrons is the same for the color-blind as for the normal-visioned. This is due to the fact that both groups possess in common the same unimpaired blue function. It follows, therefore, that since the blue excitation curve in the color-blind does not extend beyond about 520 millimicrons, it should not extend beyond that for the normal sighted. . . ."

Lawrence T. Post.

L'OCULISTICA DE ANTONIO SCARPA E DUE SECOLI DE STORIA (Antonio Scarpa's "L'Oculistica" and two centuries of history). By Giuseppe Ovio. Two octavo volumes, clothbound, 1515 pages. Published by V. Idelson, Naples. Price not given.

The appearance of two large volumes from the pen of the dean of Italian ophthalmology, covering the development of ophthalmology through the past two centuries, is an event of general interest.

Written with meticulous care, with every reference documented, we have here a thesaurus of permanent value.

Dr. Ovio is not only professor of ophthalmology at the Royal University of Rome but has also the distinction of being a senator.

His latest previous work on the "Comparative anatomy of the eye," which was at once accepted as an authority on the subject, was translated into French, but unfortunately was never made available to the English reader. The present volumes are based on the work of Antonio Scarpa* (1752-1852) and as a frontispiece have a portrait of the distinguished anatomist and surgeon who gave to the world (1801) the first scientific treatise on ophthalmology. This work was of such importance that it was reprinted within a year. Other editions followed, one posthumous in 1837, and for over two generations Scarpa's work was the controlling influence in ophthalmology throughout Europe. There had, indeed, been important contributions made to diseases of the eye before his time, and we immediately recall the name of the earlier Italian Benito de Grasso; in France Maitre Jan and St. Yves; in England Percival Pott, Benjamin Bell, James Ware, and others; but Scarpa made of ophthalmology a distinctive specialty, no longer regarding it as a subordinate branch of surgery.

It will be understood how important this was when it is realized that Beer, the father-in-law of Friedrich Jaeger, and the grandfather of Eduard Jaeger, and one of the most famous teachers of the early nineteenth century, was the first (1814) to be accorded a professor's chair in ophthalmology in the University of Vienna. Already in the middle of the nineteenth century the world had beaten a pathway to Graefe's private clinic, over a tailor shop in Johannes Street, long before he was accorded a professorship in the University of Berlin. Lectures on the eye were at that time given by the general surgeon. Bowman relinquished his general surgery only when his fame as an ophthalmologist gave him no time for other work.

The labors of Scarpa marked the end of one era and the beginning of another. The purity of the language in which he wrote was paralleled by the accuracy of his observations. New matter was introduced in each edition of Scarpa's books as a result of his wider experience.

His portrait is that of a scholar, with great breadth between the eyes, and markedly intellectual features. In studying the development of Scarpa's work during the century which preceded him and that which followed it during the past one hundred years, Professor Ovio consulted over three thousand authorities, and the bibliography occupies about one half of the second volume of nearly eight hundred pages. The work is elaborately illustrated with sketches showing the form of the earlier instruments used in eye operations, the way patients were seated during operations, the known forms of diseases of the eye, and other important details. There are two colored plates.

Park Lewis.

*See editorial, Antonio Scarpa—a great ophthalmologist," Amer. Jour. Ophth., 1934, February, page 161.

GIZA MEMORIAL OPHTHALMIC LABORATORY, Tenth Annual Report, 1935. 136 pages, illustrated. Printed by Schindler's Press, Cairo, 1936. Price 25 P.T.

This report follows the usual form of reports from the same source. It is beautifully prepared and like its predecessors a splendid example for other institutions. It is regrettable that finances will not permit many of our outstanding ophthalmic units to publish similar annual contributions. The clinician will be interested in the many unique individual case reports

which are beautifully illustrated, some of the illustrations being in colors.

The section on research is always important. Wilson's paper, read before the general assembly of the International Association for the Prevention of Blindness and of the International Organization against Trachoma, in Paris, May 11, 1936, is given in full. The subject was "The various forms of conjunctivitis among children in Egypt and the Near East," and the subtitle "Their seasonal incidence and their influence on the development of trachoma." The astonishing, almost complete absence of ophthalmia neonatorum in Egypt is discussed. This freedom from infection of the newborn is transitory, for soon other forms of ophthalmia involve the baby's eyes. The author writes, "In Egypt, the principal causes of infectious conjunctivitis are the gonococcus, the Koch-Weeks bacillus and the diplo-bacillus of Morax-Axenfeld." The least important of these is the Morax-Axenfeld. Koch-Weeks conjunctivitis and gonococcal forms are essentially acute; although habitually present they assume epidemic characters in summer. It is the rule rather than the exception for children to be infected early in life. The lower in the social scale the higher is the incidence.

"As has often been pointed out, gonococcal conjunctivitis in Egypt is not of venereal origin, the infection being carried from eye to eye." It has a seasonal incidence. Geographical position is an important factor. This is so because of the different climates of various parts of Egypt.

Koch-Weeks conjunctivitis and gonococcal cases have a definite association with the increase of flies. Regarding the relationship with trachoma, the author states that "where there is much ophthalmia there will be much trachoma provided that trachoma is endemic. The great guiding principle, therefore, in the prevention of trachoma in countries like Egypt is the prevention of the acute ophthalmias."

Year by year the reports of this Giza Memorial Ophthalmic Laboratory assume an increasing value. The entire series should be in every ophthalmic center.

Lawrence T. Post.

CAMPO VISUAL NORMAL Y PATOLOGICO (Visual field normal and pathologic). By Jorge Malbran. Stiff paper covers, 443 pages, 267 illustrations in the text. Second edition. Published by El Ateneo, Buenos Aires, 1936. Price not stated.

Dr. Jorge Malbran is oculist to the Santa Lucia Ophthalmologic Hospital of Buenos Aires, and "free dozent" of clinical ophthalmology. His compendious work on a frequently neglected branch of ophthalmology and neurology speaks brilliantly for the progressive character of medical teaching in the Argentine Republic. It is a model of the printing art, has availed itself freely of the writings of European and American authorities, and carries a carefully compiled bibliography of fifteen pages.

The text is excellently written. The introduction reviews the history of the subject from Ptolemy and Euclid through Galen, Mariotte, Purkinje, and Graefe, down to Bjerrum, Roenne, Traquair, Peter Evans, and Lloyd.

The chapter arrangement is as follows: Anatomy and physiology of the optic tract; Normal visual field; Technical bases of perimetric examination; Instruments used in perimetric examination; Methods of examination of the visual field; The pathologic visual field in general; The pathologic visual field in detail; The visual field in glaucoma; Papillary edema; Optic nerve; Chiasm; Retrochiasmal portion of the visual tract.

Dr. Malbran's work can be highly recommended to teachers and clinicians

in Spanish-speaking countries and to medical readers of Spanish everywhere.

W. H. Crisp.

OBITUARIES

WILLIAM C. BANE
1855-1936

William Cotterrell Bane was born in Washington County, Pennsylvania, November 21, 1855. He studied medicine at Jefferson Medical College in Philadelphia, receiving his M.D. in 1879. He engaged in general practice at Canonsburg, about twenty miles southwest of Pittsburgh. After some years, he became especially interested in diseases of the eye and ear and studied these branches of medicine at the Philadelphia Polyclinic. In 1891 he removed to Denver and took up special practice. He became connected with the Gross Medical College, afterwards combined with the Medical School of Denver University, and finally in the Medical School of the University of Colorado. He was Professor Emeritus of Otolaryngology of the latter institution until the time of his death.

Dr. Bane proved himself a competent consultant and teacher for otolaryngology. But his greater interest developed in the direction of ophthalmology. He was one of the first members of the Colorado Ophthalmological Society and probably has brought more interesting and important cases to its meetings, for examination and discussion, than any other member. His cases were fully studied before he showed them; they were followed up, and their subsequent progress reported to the Society, sometimes years afterwards. His reports in later years were often joint reports by W. C. and W. M. Bane.

In 1895 Dr. J. T. Eskridge, the neurologist, sent to Dr. Bane a case that puzzled him. With the ophthalmoscope Dr. Bane recognized a condition that he had not seen before. He made careful drawings of the ocular fundus. The patient was a man of 32 years, who had noticed his vision failing in one eye for four years, and for three years in the other. The appearances of the retina and its vessels were similar in the two eyes. Cases of this

William C. Bane

kind had probably been seen before this; but their real nature was not understood until von Hippel, in 1912, reported his case, with the microscopic examination of the eyeball, showing the condition was a progressive angiomatosis. Von Hippel's patient, watched for sixteen years, died at the age of fifty years. The condition became known as von Hippel's disease. Dr. Bane reported his case as "Angiomatosis of the retina," to the Colorado Ophthalmological Society, and it was published in the Ophthalmic Record, 1913, March, page 200.

Dr. Bane became interested in pemphigus of the conjunctiva, repeatedly demonstrating his cases to the Ophthalmological Society. He tried the treatment of excising the affected portion of the membrane; also reported benefit from exposure to the X ray. He made use of the sideroscope for the recognition of iron or steel in the eyeball. He devised a cheap

and efficient form of the instrument and used it, probably more than any other American ophthalmologist, although he fully utilized the X ray. He reported one case of steel in the vitreous, 7 mm. by 1 mm. in size, removed with restoration of 6/6 vision. He reported cases of retinal tuberculosis, herpes of the cornea, ophthalmic herpes zoster, and scarlet fever with destruction of the cornea.

Dr. Bane became interested in photography, and his small camera was always ready to take a group of friends, as he encountered them at the medical gatherings. Then he began to take pictures of the anterior segment of the eye. He became interested in stereoscopic pictures and worked out his own apparatus, studying the angles at which the best effect could be secured. Lastly he took up color photography. With a small camera, but the best of films for color work, he carefully worked out lighting and made as fine color photographs of the eye as have yet been produced. His paper on "Amateur photography of the exterior of the eye," illustrated by lantern slides, was read at the meeting of the Western Ophthalmological Society in 1934.

Dr. Bane's whole professional life was built on a firm foundation of personal character. He had that sympathetic, unselfish devotion to the service of others. Never seeking notoriety, he did the conscientious, scientific, thorough work that won the highest respect and confidence of his professional colleagues. In December he had an attack, of which he recognized the nature, but of which he spoke as indigestion. His death, from a heart lesion, occurred January 20, 1937.

Edward Jackson.

SIR GRAFTON ELLIOT SMITH

This famous anatomist and anthropologist, who gave the Bowman Lecture of the Ophthalmological Society of the United Kingdom in 1928, died January 1, 1937, aged 66 years. He was born in Australia, the son of the headmaster of the State School in Sidney. At the age of 17 he began the study of medicine, and while still a student was made Prosector to the Professor of Anatomy in the University of Sidney. In 1896 Smith went to Cambridge, England, worked on comparative anatomy, and in 1900 was appointed Professor of Anatomy in the Government Medical School in Cairo, Egypt, where he became interested in anthropology and worked out the life history of the ancient inhabitants of the Nile Valley.

In 1909 he became Professor of Anatomy in the University of Manchester, England; in 1919, Professor of Anatomy in the University College, London. He received many academic honors and was knighted in 1934. A colleague at Manchester writes to the Lancet: "He attracted many research workers from the schools," and "Elliot Smith probably did more than any other person to reform the teaching of anatomy."

His Bowman Lecture carried on the line of thought advanced by his predecessors, Mr. Treacher Collins and Sir John Parsons, with reference to the evolution of human vision and the brain. He pointed out that the great development of the cerebral convolutions, which marks the greatest difference between the human brain and those of the lower animals, came with the development of the macula for exact vision and with the use of the two eyes together in binocular vision and the necessary binocular movements.

There are parallels between the development of Sir Grafton Elliot Smith, and that of Sir William Osler.

Edward Jackson.

ABSTRACT DEPARTMENT

EDITED BY DR. WILLIAM H. CRISP

Abstracts are classified under the divisions listed below, which broadly correspond to those formerly used in the Ophthalmic Year Book. It must be remembered that any given paper may belong to several divisions of ophthalmology, although here it is only mentioned in one. Not all of the headings will necessarily be found in any one issue of the Journal.

CLASSIFICATION

1. General methods of diagnosis
2. Therapeutics and operations
3. Physiologic optics, refraction, and color vision
4. Ocular movements
5. Conjunctiva
6. Cornea and sclera
7. Uveal tract, sympathetic disease, and aqueous humor
8. Glaucoma and ocular tension
9. Crystalline lens
10. Retina and vitreous
11. Optic nerve and toxic amblyopias
12. Visual tracts and centers
13. Eyeball and orbit
14. Eyelids and lacrimal apparatus
15. Tumors
16. Injuries
17. Systemic diseases and parasites
18. Hygiene, sociology, education, history
19. Anatomy, embryology, and comparative ophthalmology

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CORNEA AND SCLERA

Haemmerli, Victor. **Cyclic edema of the cornea.** Klin. M. f. Augenh., 1936, v. 97, Dec., p. 745.

A quarry laborer stated that from his ninth or tenth year from early morning until about noon he had seen everything as through a veil, which disappeared in the late morning hours with improvement of sight. In the course of time he was examined almost at every hour of day and night. In the early morning both corneae showed slight haziness from changes of the endothelium and edema of the parenchyma with vacuoles in the epithelium, which from 9 a.m. disappeared, leaving a slight haziness. The lowest vision in the morning was R.O. 35, L.O. 4, the best in the afternoon R.O. 8, L.O. 9. The cycle of onset and disappearance of corneal opacities and epithelial vacuoles recurred every 24 hours. Internal and neurologic examinations were negative. The patient is the youngest of the twelve cases so far reported. Haemmerli considers the etiology unsolved.

C. Zimmermann.

Khoroshina, A. G. **The effect of pyrogenic factors on the course of parenchymatous keratitis.** Sovietskii Viestnik Opht., 1936, v. 9, pt. 6, p. 865.

A case of severe parenchymatous keratitis which recovered rapidly during a severe attack of typhus.

Ray K. Daily.

Kiang, S. M. **Anomalous changes of cornea and iris in the new-born.** Chinese Med. Jour., 1936, v. 50, Oct., pp. 1494-1495.

Kiang describes an eight-month premature baby with a diffusely cloudy cornea due to increased density of the corneal stroma. The iris showed a fine reddish ring at the site of the minor circle and fine reddish radiating streaks in its ciliary portion. The findings were interpreted as representing a certain stage in the development of the membranes during fetal life. As the condition disappeared within one month after birth, it is suggested that at birth the pigment in the anterior border layer of the iris was scanty or absent, hence the blood vessels were exposed to view.

Lawrence G. Dunlap.

Komarovich, L. B. **Treatment of serpiginous ulcer.** Sovietskii Viestnik Opht., 1936, v. 9, pt. 6, p. 897.

The author lays great stress on treatment of the lacrimal sac in all cases of corneal ulcer. Locally he cauterizes the ulcer with twelve percent optochin.

Ray K. Daily.

Krilov, T. K. **Therapy of acne rosacea of the cornea.** Sovietskii Viestnik Opht., 1936, v. 9, pt. 5, p. 700.

The author found subconjunctival injections of mercury oxycyanide very effective. Ray K. Daily.

Kwaskowski, Adam. **Gumma of the sclera.** Klinika Oczna, 1936, v. 14, pt. 6, p. 742.

A report of a case in a woman infected four years previously and untreated. She recovered under luetic treatment. Ray K. Daily.

Nazarov, I. I. **Corneal transplantation on leprous eyes.** Sovietskii Viestnik Opht., 1936, v. 9, pt. 5, p. 632.

A detailed clinical and pathologic report of corneal transplantation from a normal person into an eye affected by leprosy. The healthy cornea took in the leprous eye and maintained its transparency indefinitely. Three to four days after the operation leprous granulation tissue appeared at the edge of the trephine opening of the leprous cornea, and in a short time closed the entire line of junction. Simultaneously, inflammatory phenomena appeared in the anterior ocular segment. The study suggests that cornea and lens are most resistant to the leprous process, and that vision is usually lost through involvement of the iris and ciliary body. The case also shows the deleterious effect of surgical trauma on an eye with advanced leprosy. Ray K. Daily.

Nižetić, Z. **Cornea of cadavers as material for transplantation.** Klin. M. f. Augenh., 1936, v. 97, Dec., p. 756.

The author reports 24 cases (18 in children), of transplantations using the cornea of the dead, excised from 24 to 48 hours after death. Autopsies gave a more precise and accurate aspect of the condition of the donor than in transplantations from the living. The technique is described in detail. No transplant was lost, all grew in, even in two infected cases. Five transplants remained clear, 6 transparent, 13 became opaque. Preservation of transparency does not depend upon the material but on the bed on which transplantation is done. All cases were operated on without selection for favorable keratoplasty, and among them were only a few without complicated total leucoma. One eye retained complete transparency without change for about three years. C. Zimmermann.

Ochi, S. **Two cases of permanently clear healing of corneal implants in optical keratoplasty.** Klin. M. f. Augenh., 1936, v. 97, Dec., p. 761.

Two cases of successful homoplastic, circumscribed, penetrating, optical keratoplasty with homologic corneal tissue are described. The author's discussion includes changes of the cornea of the host as nutrient soil for the transplant, selection of the site of transplantation, and vitality of the transplant (dependent upon age of donor and technical skill in operation). The blood group of host and donor need not always be the same. (Illustration.)
C. Zimmermann.

Pokhisov, H. **A new electrotrephine for corneal transplantation.** Sovietskii Viestnik Opht., 1936, v. 9, pt. 6, p. 861.

A description of a trephine, with a shoulder to limit the extent of penetration, run by electricity in the manner of a dental burr. (Illustration.)
Ray K. Daily.

Rinaldi, S. **Local treatment of corneal lesions by vitamins A and D.** Ann. di Ottal., 1936, v. 64, Aug., p. 505.

The local use of vitamins in various cutaneous lesions such as injuries, burns, abscesses, and ulcerations led the author to make a series of investigations on animal corneas septically infected and in various human cases of keratitis. His observations lead him to the conclusion that both in the animals and in the human subjects the course of the affection was materially modified by the instillation in the conjunctival sac of a mixed oily preparation of the vitamins A and D. (Bibliography.)
Park Lewis.

Soudakoff, P. S. **Keratitis ulcerosa and non-ulcerosa produced by diploba-**

cillus Petit. Chinese Med. Jour., 1936, v. 50, Oct., pp. 1415-1420.

Three cases are reported. The organisms recovered from corneal scrapings were gram-negative diplobacilli shorter and thinner than the Morax-Axenfeld diplobacillus, and pathogenic for the cornea but not for the conjunctiva. Keratitis produced by the diplobacillus of Petit either takes a mild course, with non-ulcerating infiltrates of about three weeks' duration, or appears with the picture of coalescing infiltrations followed by crescent-shaped, relatively benign ulcers which respond to zinc sulphate treatment.

Lawrence G. Dunlap.

Tsou, C. C. **Band-shaped keratitis.** Chinese Med. Jour., 1936, v. 50, Oct., pp. 1423-1426.

A case of bilateral primary band-shaped keratitis was discovered in a Chinese patient. Treatment by curettage was of no avail. The etiologic factors and pathologic changes were discussed. Lawrence G. Dunlap.

Weigelin, S. **Alleged spontaneously developed folds of Descemet's membrane in an otherwise normal eye.** Klin. M. f. Augenh., 1936, v. 97, Dec., p. 772.

In the nonirritated right eye of a girl of 25 years were about eight vertical opaque curved streaks extending completely across the posterior surface of the cornea. The slitlamp revealed that they were cicatrized tears of Descemet's membrane. Vision after correction of 2 D. of corneal astigmatism was 6/36. The left eye was normal. The author assumes an injury perhaps in earliest childhood. (Illustration.)

C. Zimmermann.

Zolotareva, M. M. **Meibomian keratitis.** Sovietskii Viestnik Opht., 1937, v. 9, pt. 5, p. 693.

A report of six cases. The basis of the disease is hyperfunction or dysfunction of the meibomian glands. Not infrequently this disturbance complicates and retards recovery of a trachomatous pannus. The disorder responds to therapy but tends to recur.

Ray K. Daily.

7

UVEAL TRACT, SYMPATHETIC DISEASE, AND AQUEOUS HUMOR

Alonso, A. F. **Medico-chirurgical treatment of acute luetic iridocyclitis.** Anales Soc. Mexicana de Oft. y Oto-Rino-Laring., 1936, v. 11, July-Sept., pp. 16-24.

In acute syphilitic inflammations of the optic nerve, the retina, and the uveal tract, the author prefers to begin with mercury or mercury and bismuth, because of the dangers which intense local reactions may involve when the arsenobenzol preparations are primarily resorted to. He also recommends puncture of the anterior chamber in acute iridocyclitis of specific origin.

W. H. Crisp.

Bertoldi, Maria. **Bilateral chorioretinitis with massive exudation.** Rassegna Ital. d'Ottal., 1936, v. 5, May-June, p. 371.

Disseminated chorioretinitis appeared in the right eye of a thirty-year-old woman during the third month of pregnancy. The second eye presented a similar picture eleven months later. In the equatorial periphery of the retina were patches of disseminate chorioretinitis, while the peripapillary and central regions showed whitish streaks bordered by pigment. In the second eye, observed during evolution of the process, the patches of exudate were marked and elevated the retina. All physical and laboratory examinations were negative except for digitations on the inner surface of the skull and enlarged optic foramina. These signs, plus severe headaches and change in the spinal fluid, suggest a mild serous meningitis. The vision was ultimately very greatly lowered.

Eugene M. Blake.

Fine, M., and Barkan, H. **Essential progressive iris atrophy.** Amer. Jour. Ophth., 1937, v. 20, March, pp. 277-280.

Kiang, S. M. **Anomalous changes of cornea and iris in the new-born.** Chinese Med. Jour., 1936, v. 50, Oct., pp. 1494-

1495. (See Section 6, Cornea and sclera.)

Kiang, S. M. **Bilateral metastatic ophthalmia complicating epidemic cerebrospinal meningitis.** Chinese Med. Jour., 1936, v. 50, Oct., pp. 1498-1499.

On the fifth day of the attack of epidemic cerebrospinal meningitis the patient became totally blind in each eye, there remaining neither light perception nor projection. Ten months later the right eye had nearly normal vision but the left eye light perception only. Lawrence G. Dunlap.

Kiang, S. M. **Hydrophthalmos in the new-born.** Chinese Med. Jour., 1936, v. 50, Oct., pp. 1496-1497.

A full-term baby was thought to have no pupils. But the corneas were diffusely cloudy and ectatic, and tension 30 to 60 mm. Hg Schiötz. Elliot trephining was done but the patient was lost sight of after a chronic iridocyclitis developed. Kiang considers that the condition had begun early in uterine life so that at birth the changes were already advanced. Lawrence G. Dunlap.

Lapierre, Jean. **A case of polycoria.** Klinika Oczna, 1936, v. 14, pt. 6, p. 735.

A report of high myopia with bilateral optic atrophy and bilateral polycoria. Ray K. Daily.

Luo, T. H. **Uveitis associated with alopecia, poliosis, dysacousia and vitiligo.** Chinese Med. Jour., 1936, v. 50, Oct., pp. 1409-1414.

This case, the first of its kind reported in China, although many have been reported from Japan, was characterized by binocular involvement, severe and rapid course, and disturbances of the hearing apparatus, skin, and hair. A close resemblance of the clinical picture to that of sympathetic ophthalmia was noted, and Verhoeff's treatment for the latter condition, diphtheria antitoxin, was used, but blindness resulted.

Lawrence G. Dunlap.

Meesmann, A. **Treatment of rheumatic iritis with bee toxin.** Klin. M. f. Augenh., 1936, v. 97, Dec., p. 727.

Bee toxin in the form of "apicosan" is injected intracutaneously. It is dispensed in seven ampoules which are sufficient for a cure. Recently it has also been applied percutaneously by inunction of "forapin." Three favorable cases are reported and explanations of the immunizing action by different authors are discussed. C. Zimmermann.

Schwarzenburg, C. **Two cases of sympathetic ophthalmia cured by injections of atophanyl.** Chinese Med. Jour., 1936, v. 50, Oct., pp. 1433-1448.

The first case of sympathetic ophthalmia of short duration improved from finger counting at a distance of 0.5 meter to 5/5 in eight months after six injections of cylotropin and 112 of atophanyl. The second case of five months duration improved from hand movements to 5/5 in two years after nineteen injections of cylotropin and 203 injections of atophanyl.

Lawrence G. Dunlap.

Tree, M. **Familial hyaline dystrophy in the fundus oculi or Doyne's family honeycomb "choroiditis."** Brit. Jour. Ophth., 1937, v. 21, Feb., pp. 65-91.

To aid in the early recognition of hyaline degeneration, the author (by collecting case notes of all likely patients attending Oxford Eye Hospital since 1896) gathered records of twenty affected and twelve unaffected cases. He uses the following division headings: state of refraction, visual fields, light sense and color thresholds, general systemic examination, examination of fundi and media, and differential diagnosis. (2 genealogic trees, 5 photomicrographs.) D. F. Harbridge.

Vianna, A. **A case of striate choroiditis.** Ann. d'Ocul., 1936, v. 173, Dec., pp. 954-957.

A woman of 22 years complained of defective vision of the left eye, first noted two years earlier when four months pregnant. Vision of the left eye was reduced to 1/50, and there was a marked field defect with paracentral scotoma. Very peculiar orange-yellow striae extended over the temporal and

inferior portions of the fundus. These striae branched irregularly, forming no definite pattern. Retinal vessels crossed them superficially. The peripapillary area was lighter in color than the rest of the fundus. General and laboratory examinations were essentially negative. After several months during which no change was noted, the retina became edematous. An area of detachment without tear developed at the site of one of the broader striae. The detachment later disappeared. Several injections of "Cinnozyl" were given. The lesions present were apparently exudative in character, differing thereby from the degenerative lesions of angioid streaks of the retina. No cause for the lesions was found but the onset during pregnancy may be of significance. (Fundus drawing in color.)

John C. Long.

Yao, F. H. **Atrophy and separation of the anterior stroma layers of the iris.** Chinese Med. Jour., 1936, v. 50, Oct., pp. 1421-1422.

A case of bilateral absolute glaucoma of one month duration showed atrophy of the entire iris stroma with separation of the anterior layers, producing a picture reminding one of paper hanging down and peeling from a wall. The deeper stroma layers exposed by separation of the anterior layers appeared sclerosed and atrophic.

Lawrence G. Dunlap.

8

GLAUCOMA AND OCULAR TENSION

Bailliart, P. **Some considerations on clinical measurement of ocular tension.** Ann d'Ocul., 1936, v. 173, Dec., pp. 945-953.

The tonometric measurement is only a relative clinical figure and not an absolute index of intraocular tension. A number of factors influence the reading obtained. They include model of instrument, oscillations of ophthalmotonus from variations in body and head position, pulmonary and cardiac movements, action of extrinsic and intrinsic ocular muscles, emotional factors, corneal curvature, and time of day. With the usual tonometer (excluding the MacLean), pressures between 25 and 30 mm. are presumptive evidence of hypertension. John C. Long.

Duc, Camillo. **Glaucoma surgery and the permeability of the cicatrix in the trephine operation.** Rassegna Ital. d'Ottal., 1936, v. 5, July-Aug., p. 446.

Duc reviews the theories underlying the operations of iridectomy, sclerotomy, and trephining and gives the opinions of authorities from Graefe to date. He then reports upon histologic study of two eyes enucleated some time after an Elliot trephine operation which had not reduced tension. Microscopically the corneal and scleral borders of the trephine opening were clearly defined and there was no evident relation of these tissues to the connective tissue which obstructed the trephine opening. In the new-formed tissue were large cells with abundant cytoplasm completely filled with black granules, resembling the pigmented elements of the retina. The disposition and nature of this tissue explained the failure of drainage after the operation. Based upon clinical observation, the author presents his views upon conditions which favor or obstruct permanent drainage, regardless of the type of operation. These are the type of glaucoma, the condition of the iris, and increased tension persisting after trephining. Certain forms of cyclitis lead to increased postoperative tension, sometimes alternating with periods of normal or subnormal tension. He stresses the need of atropine after trephine operations, to prevent iris adhesions, and he feels that in certain cases this drug is favorable to formation of a filtering cicatrix. (4 figures.)

Eugene M. Blake.

Heine, L. **Cyclodialysis.** Klin. M. f. Augenh., 1936, v. 97, Dec., p. 721.

Heine quotes two contributions in 1935 as manifesting progress in the literature of cyclodialysis. One is the report by Grósz from the eye clinic of the University of Budapest, demonstrating the ascendancy of cyclodialysis in the operations for glaucoma. The

other is the report from the Prague clinic by Vannas, where cyclodialysis is done rather extensively. Heine urges the advantages of cyclodialysis over trephining. C. Zimmermann.

Sapir, I. M. **The effect of tenotomy of the recti muscles on intraocular tension in glaucoma.** Sovietskii Viestnik Opht., 1936, v. 9, pt. 6, p. 822.

The author found that tenotomy of the recti muscles produced a temporary but fairly prolonged fall in intraocular tension in primary as well as secondary glaucoma. The same effect was produced by tying the tendons, or cauterizing them, thus closing the anterior ciliary arteries. These experiments prove, it is pointed out, that the fall in intraocular pressure is due to exclusion of the blood vessels. Ray K. Daily.

Strachov, V. P. **The choice of operation for glaucoma.** Sovietskii Viestnik Opht., 1936, v. 9, pt. 5, p. 623.

A didactic evaluation of the various antiglaucomatous surgical procedures. Ray K. Daily.

9

CRYSTALLINE LENS

Argañaraz, R. **An apparatus for cup and vacuum cataract extraction. Phacoerisis.** Arch. de Oft. de Buenos Aires, 1936, v. 11, Nov., p. 615; also La Semana Med., 1937, v. 44, Feb. 4, pp. 321-324.

The apparatus with which the author has successfully extracted "over twenty cataracts" in capsule includes an ordinary 20-c.c. glass syringe, a flexible rubber tube 50 cm. in length with relatively firm walls, a release, and two small vacuum cups or erisiphakes, measuring 3.5 by 5 mm. and 4.5 by 5 mm. respectively. Vacuums of 5, 10, or 15 c.c. produced by pulling out the plunger are said to be equivalent to 30, 50, or 70 mm. of mercury. While the vacuum is effective the plunger is locked in position with a catch. To obtain hermetic contact between the plunger and the walls of the syringe, the author uses sterile lanolin or a similar fatty substance. The release is similar to that used in blood transfusion. The assistant "charges" the syringe (creates the vacuum) immediately after the surgeon has executed the corneal flap and the iridectomy, in order to avoid weakening of the vacuum during a prolonged delay.

The author argues that since only sixty percent of successful intracapsular extractions are achieved with the capsule forceps by experienced surgeons, vacuum extraction is destined to replace use of the capsule forceps. The vacuum cup is applied over the anterior pole of the lens under control of the surgeon's eye. Rupture of the zonule is achieved by first rotating the lens on its anteroposterior axis and then by rolling and pitching movements. Delivery is effected by tumbling with the vacuum cup. In the young it may be necessary to repeat the maneuver of zonule rupture once or twice, a circumstance found of no consequence in the postoperative course. Iridectomy, total or peripheral, according to circumstances, or iridotomy, and good mydriasis are essential. To avoid striped keratitis the corneal flap is turned down only in case of a peripheral iridectomy. M. Davidson.

Dirion, J. K. **Technique associated with intracapsular cataract extraction.** Amer. Jour. Ophth., 1937, v. 20, March, pp. 299-300.

Duthie, O. M. **Intracapsular cataract extraction.** Brit. Jour. Ophth., 1937, v. 21, Jan., pp. 16-22.

The paper is based upon 100 cases, the principles of Sinclair (see Amer. Jour. Ophth., 1933, v. 16, July, p. 653) having been followed. The author presents his results and makes certain suggestions to reduce iris and vitreous prolapse. Modifications of local anesthesia found valuable are also given. Superiority of the method used is claimed and demonstrated by findings. (References.) D. F. Harbridge.

Isassi, H. F. **Different operative techniques for cataract.** Anales Soc. Mexicana de Oft. y Oto-Rino-Laring., 1936, v. 11, Oct.-Dec., pp. 77-89.

The author describes the technique adopted by five Spanish ophthalmologists, Diaz-Caneja, Barraquer, Castresana, Poyales, and Marquez. Except Marquez, who still advocates extracapsular extraction with iridectomy, all employ peripheral iridectomy and intracapsular extraction; the first two with forceps, Barraquer with his erisiphake, and Poyales by Smith's pressure method. W. H. Crisp.

Lijo Pavia, J. **Two models of hand-operated vacuum apparatus for extraction of cataract.** Arch. de Oft. de Buenos Aires, 1936, v. 11, Nov., p. 623. (See Amer. Jour. Ophth., 1937, v. 20, April, p. 445.)

Wieczorek, Anton. **Psychic disturbances after cataract extraction.** Klinika Oczna, 1936, v. 14, pt. 6, p. 762.

Through a questionnaire addressed to the Polish ophthalmologists the author collected twenty cases of postoperative psychosis, mostly in very old people. Prolonged preoperative anxiety, constitutional tendencies, senile changes, misinterpreted comments in the operating room, binocular occlusion, and in some people atropin were the etiologic factors. The disturbances usually take the form of delusions of persecution, they are not difficult to treat, and most of them subside when the good eye is left open. There is no relation between the degree of psychic disturbance and the postoperative course of the eye. As a rule the psychosis has no effect on the eye, although in some cases eyes were lost through secondary infection, corneal abscess, and traumatism. Ray K. Daily.

Wright, R. E. **Lectures on cataract. 3. Anterior-segment and other complications in the postoperative period.** Amer. Jour. Ophth., 1937, v. 20, March, pp. 240-253.

10

RETINA AND VITREOUS

Ballantyne, A. J., and Michaelson, I. C. **A case of perivasculitis retinae associated with symptoms of cerebral disease.** Brit. Jour. Ophth., 1937, v. 21, Jan., pp. 22-35.

The author suggests that perivasculitis retinae is not the expression of a single disease, but a clinical phenomenon common to several diseases, distinguished from each other by such features as differences of age incidence, localization in veins alone or in both arteries and veins, more or less peripheral situation of the early lesions, rapidity of the pathologic process, the occurrence of vitreous hemorrhage, and disturbances of the central nervous system. (References, 2 diagrams, 19 photomicrographs.) D. F. Harbridge.

Bedell, A. J. **Sudden occlusion of retinal arteries.** Amer. Jour. Ophth., 1937, v. 20, March, pp. 237-240; also Trans. Amer. Ophth. Soc., 1936, v. 34, p. 199.

Busacca, Archimedes. **Cyst in the vitreous body.** Folia Clin. et Biol., 1936, v. 8, no. 3, p. 66.

This is a report of a single case. The cyst was pigmented and about two millimeters in diameter. Its origin could not be definitely determined, but it came probably from the epithelium of the retina or ciliary body. F. A. Wies.

Kovarskaja, S. S. **Angioid streaks and pseudoxanthoma elasticum.** Sovietskii Viestnik Opht., 1936, v. 9, pt. 6, p. 836.

A case with macular degenerative changes. The writer emphasizes the importance of early diagnosis and vocational guidance for such cases. Ray K. Daily.

Ling, W. P. **Total detachment of retina in subacute nephritis.** Chinese Med. Jour., 1936, v. 50, Oct., pp. 1500-1501.

Small retinal detachments progressed to complete bilateral detachment ten days before death. Vision was reduced to light perception at a few centimeters but light projection remained fairly good in all directions. Lawrence G. Dunlap.

Merkulov, I. I. **True staphyloma of the macula.** Sovietskii Viestnik Opht., 1936, v. 9, pt. 5, p. 652.

To the two cases recorded by Guist and Witwe the author adds two cases. The patients, a man of seventeen and a woman of sixteen years, presented similar anatomic anomalies, of macular colobomas; and the same functional disturbances, low visual acuity, hemeralopia, and diminished dark adaptation. The author feels that such cases form distinct clinical entities and he suggests that they be called syndromes of true macular staphyloma.

Ray K. Daily.

Schiff-Wertheimer. **On the situation of retinal tears.** Ann. d'Ocul., 1937, v. 174, Jan., pp. 39-43.

If retinal detachments are classified into three groups, the position of the tear may be predicted for each group.

In group one, in myopic individuals of middle age, the tear is in the upper portion of the retina near the vertical meridian. In the right eye, for example, the position is usually between the 11 and 2 o'clock positions. In group two, in non-myopic individuals beyond middle age, the tear is usually along the horizontal meridian, most often on the temporal side. For the right eye this would be between 11 and 2 o'clock. In group three, in children or nonmyopic young people, the tear is usually a disinsertion at the ora in the inferotemporal quadrant. For the right eye this would be between 7 and 9:30 o'clock.

John C. Long.

Sobhy Bey, M. **Detachment of retina originating from the macula, and its surgical treatment.** Folia Ophth. Orientalia, 1936, v. 2, Oct., p. 211.

In connection with six observations of his own, the author discusses origin, diagnosis, and operative treatment. He used chiefly Lindner's undermining method and cauterizing with caustic potash, and diathermic coagulation according to Safar and Weve, in which the Coppez electric pyrometer rendered excellent service. In four of the five cases operated upon he obtained complete cure. He emphasizes the necessity of ophthalmoscopic localization and control during operation.

R. Grunfeld.

Solanes, M. P. **Persistence of canal of Cloquet in the adult human eye.** Anales Soc. Mexicana de Oft. y Oto-Rino-Laring., 1936, v. 11, Oct.-Dec., pp. 71-76.

Persistence of the canal was demonstrated in four adult eyes enucleated for various reasons.

Stallard, H. B. **Catholysis in the treatment of retinal detachment. A preliminary note.** Brit. Jour. Ophth., 1937, v. 21, Jan., pp. 35-44.

The author finds catholysis of value for locating a retinal hole as related to the external surface of the sclera. This cauterization is found sufficient for sealing small holes in the lower retina but not for larger holes and tears in the upper half. The method is still too new to determine its full value. (3 figures, references.)

D. F. Harbridge.

Tillema, A. **Infantile and congenital retinal fold.** Brit. Jour. Ophth., 1937, v. 21, Feb., pp. 94-98.

In this case, in a three-year-old boy, the anomaly was inflammatory in origin, probably retinitis. Examination of the excised globe showed the inflammatory changes most marked in the region of the large fold of the retina. (5 figures, references.)

D. F. Harbridge.

Unsworth, A. C., and Larkin, K. F. **A new diathermy point for retinal detachment.** Amer. Jour. Ophth., 1937, v. 20, March, pp. 296-298.

11

OPTIC NERVE AND TOXIC AMBLYOPIAS

Bengisu, Naci. **Enlargement of the sella turcica and atrophic excavation of the papilla without ocular hypertension in a case of elephantiasis.** Folia Ophth. Orientalia, 1936, v. 2, Oct., p. 218.

Elephantiasis of the left upper eyelid

and left temporal part of the head and hypertrophy of the left half of the face were associated with enlargement of the sella turcica. There was atrophic excavation of the papilla with temporal pallor but without hypertension. The field was contracted, but no hemianopia was found. The excavation might be explained as due to possible existence of Schnabel's caverns in the optic nerve in connection with a lymphangioma.

R. Grunfeld.

Chung, H. L. **Optic atrophy and amaurosis following typhus fever.** Chinese Med. Jour., 1936, v. 50, Oct., pp. 1427-1432.

Involvement of the nervous system in typhus fever is both profound and widespread. Mental changes are so common that a case is not considered typical without them. All twelve cranial nerves may be attacked, most commonly the optic, facial, and auditory. Chung describes the case of a fifteen-year-old boy with temporary bilateral optic atrophy and temporary but complete blindness of both eyes, which occurred late in the course of the fever.

Lawrence G. Dunlap.

Kosmin, V. I. **Treatment of optic atrophy with retrobulbar injections of atropin.** Sovietskii Viestnik Opht., 1936, v. 9, pt. 5, p. 686.

A brief review of the literature and a tabulated report of 35 cases of optic atrophy of various etiology, each treated with ten retrobulbar injections of one percent atropin in each eye. Vision was improved in 73.5 percent of the cases. Unilateral injections raised the visual acuity of the untreated eye in 58.3 percent of the cases. In 58.3 percent of nonprogressive cases, such as postneuritic atrophy and plasmocide poisoning, there was some widening of the diameter of the retinal blood vessels and hyperemia of the disc. In 41 percent of the cases there was enlargement of the visual fields. The injections do not dilate the pupil and apart from some dryness of the mouth they produce no undesirable symptom. Improvement in visual acuity became apparent after the fourth injection. Ray K. Daily.

12

VISUAL TRACTS AND CENTERS

Rubino, Agostino, and Rubino, Alfio. **A cystic tumor of the third ventricle with prevalent ocular symptomatology.** Riv. Oto-Neuro-Oft., 1936, v. 13, July-Aug., pp. 343-388.

A few days after severe injury to the right maxillary region, a man of 25 years became affected by symptoms of increased intracranial tension, and a few months later vision progressively failed. Together with other general symptoms he showed bilateral optic atrophy and concentric contraction of the visual fields. After discussion of the eye symptoms, and also of rachicentesis findings and cranial radiographs, the author concludes that the patient was affected by an intraventricular cystic tumor. (Bibliography, 8 figures.)

M. Lombardo.

Tommasini-Mattiucci, Arduino. **A case of blindness from symmetric metastatic abscesses of occipital lobes and right hemiplegia from abscesses of left parietal lobe.** Riv. Oto-Neuro-Oft., 1936, v. 13, July-Aug., pp. 329-342.

After a recent attack of pulmonary symptoms, a woman of forty years affected by recurrent attacks of pneumonia became paretic in the right arm and suddenly blind in both eyes. Postmortem examination showed multiple bronchiectases with purulent inflammation of the lower lobe of the left lung, abscesses of the left parietal lobe, and abscesses of the occipital lobes, evidently metastatic. (Bibliography, 2 figures.) M. Lombardo.

13

EYEBALL AND ORBIT

Alamilla, G., and Branly, M. A. **Orbital cellulitis in infancy.** Rev. Cubana Oto-Neuro-Oft., 1936, v. 5, Sept.-Oct., p. 137.

Attention is called to the facts that in children below the age of seven years the frontal and sphenoidal sinuses are still poorly developed and the maxillary sinus not completely developed, and that the ethmoidal sinuses are mainly

responsible for any orbital invasion from paranasal accessory sinuses. Eight cases of orbital cellulitis following sinus infection, due to streptococci and staphylococci, in children ranging in age between fourteen months and nine years, are reported and illustrated. All were without fatality. The maxillary sinus was involved in six cases. The virulence of the infection is illustrated by the interval of only three days between onset of nasopharyngitis and appearance of orbital cellulitis with exophthalmos. In two cases there was abdominal pain on the side of the nose and eye involvement. Rapid evacuation of the orbital abscess by incision through the lower lid into the lower outer orbital cavity, combined with simultaneous drainage of the nasal sinuses, is considered essential and is credited with the good results in the cases reported. M. Davidson.

Berens, Conrad. **Enucleation with implantation of foreign substances into Tenon's capsule.** Amer. Jour. Ophth., 1937, v. 20, March, pp. 293-296.

Ehlers, Holger. **Clinical investigations on the inflammatory orbital affections.** Acta Ophth., 1937, Supplement 12.

A report of 36 acute orbital inflammations with a 14 percent mortality, classified under collateral orbital edema, subperiosteal or preseptal abscess, and orbital phlegmon. The final diagnosis of collateral orbital edema can be made only after spontaneous recovery. Treatment should be directed to the causative inflammation with only mild measures to the orbit. Surgery for edema is unnecessary and may be harmful. One of the important signs of a subperiosteal abscess is vertical or lateral displacement of the eyeball. Therapy here consists in prompt subperiosteal evacuation and drainage, but with avoidance of opening the tarsoorbital fascia and of contaminating the orbital tissues. Orbital phlegmon is the most serious inflammatory orbital affection, three out of eight of the author's cases ending fatally. Its treatment consists in wide deep incisions, enucleation where vision is lost, antiphlogistic applications, and parenteral injections. Ocular complications are frequent, and eight patients lost the eye or vision. Origin of the orbital inflammation was in the lacrimal sac; in infections of the face; in dental, ear, and sinus infections. Ray K. Daily.

Esser, J. F. S. **"Epithelial inlay" for the formation of cutaneous sacs destined to receive an artificial eye.** Ann. d'Ocul., 1936, v. 173, March, pp. 208-212.

The author describes his technique of forming a sac suitable for prothesis when there is an inadequate amount of conjunctiva. The cavity is enlarged to suitable size by incision. This leaves an area uncovered by epithelium. An exact cast of the cavity is made of dental wax ("stents"). The face of the cast destined to come in contact with the wound is covered with skin, the epidermal surface facing the wax. The cast is then replaced in the cavity and pressure applied for a week. This method of skin grafting is suitable for other cavities. A case of orbital reconstruction is reported with photographs. John C. Long.

Essex, H. E., and Corwin, W. C. **Experimental "exophthalmos" in dogs.** Amer. Jour. Ophth., 1937, v. 20, Feb., pp. 153-157.

Fialho, Abreu. **Comments on localization and action of the staphylococcus in the eye and its adnexa.** Annaes de Ocul. do Rio de Janeiro, 1936, v. 5, no. 4, p. 9.

The patient, a man of twenty-five years, librarian by occupation, had a rise of temperature, and the left side of his face was greatly swollen and painful, the point of maximum tenderness being over the upper border of the orbit. He had been repeatedly affected by furunculosis. A deep incision in the region of the orbital margin yielded thick pus, which upon microscopic examination showed staphylococci. Other lines of investigation being negative, the diagnosis made was of acute periostitis at the upper border of the orbit, secondary to trauma. Since the systemic

reaction persisted and the swelling of the face showed little improvement, the patient was given a series of intramuscular injections of a staphylococcic vaccine. The first injection produced a marked rise of temperature. After the second injection, without marked general reaction, the condition rapidly improved. W. H. Crisp.

Gallenga, Riccardo. **An orbital complication of anterior ventricular puncture.** Rassegna Ital. d'Ottal., 1936, v. 5, May-June, p. 380.

A five-year-old boy with symptoms of brain tumor developed paresis of the left lateral rectus and six diopters of swelling of both discs. To lower intracranial pressure it was decided to puncture the lateral ventricle by the anterior, transorbital method of Dogliotti. Fluid under great pressure was evacuated, but because symptoms of collapse developed no air was injected for ventriculography. An exploratory trephining was done to expose the cerebellum, but no tumor was found. Three hours after the anterior puncture stupor appeared, with exophthalmos of 5 mm., fixation of the globe, and such intense chemosis of the upper part of the conjunctiva as to prevent closure of the lids. Other symptoms of orbital hypertension included dyspnea, arhythmic pulse of 48-52, and anuria. All signs of increased orbital pressure had cleared by the fourth day but the papilledema had reached 9 D. The fluid in the orbit was undoubtedly cerebrospinal and not a hematoma. The condition was one of internal hydrocephalos. (3 figures.)
Eugene M. Blake.

Glover, L. P. **Panophthalmitis from an encapsulated orbital abscess.** Amer. Jour. Ophth., 1937, v. 20, Jan., pp. 61-62.

Gump, M. E., Hester, E. G., and Lohr, O. W. **Monocytic chloroma (reticulocystoblastoma with monocytic leukemia).** Arch. of Ophth., 1936, v. 16, Dec., pp. 931-949.

The case of a man, aged 55 years, who presented monocytic leukemia in association with a neoplastic infiltration of both orbits is reported in detail. The first symptom was fatigue of the eyes, followed by exophthalmos, gingivitis, diminution of vision and hearing, petechial hemorrhages, and septic temperature. Death ensued after five months. The authors review the literature on chloroma, monocytic leukemia, and the reticulo-endothelial system, and from the microscopic appearance of the tissues suggest the name monocytic chloroma for this condition.
J. Hewitt Judd.

Khalil, M. **Retrobulbar abscess and multiple abscesses in the body after typhoid fever.** Bull. Ophth. Soc. Egypt, 1935, v. 28, p. 170.

Multiple abscesses occurred at intervals for a month before the appearance of the retrobulbar abscess, which had been present for a month before the patient, a boy of seven years, was seen. The smears and cultures of the pus obtained by drainage of the retrobulbar abscess were negative.
Edna M. Reynolds.

Lin, C. K. **Restoration of the eye socket with a Thiersch graft.** Chinese Med. Jour., 1936, v. 50, Oct., pp. 1335-1344.

The Wheeler technique was successful in five out of six cases but Lin stresses the importance of inserting a smaller dental-wax mold to prevent shrinking of the socket after the larger mold is removed.
Lawrence G. Dunlap.

Lipovich, H. G. **Alternating exophthalmos and enophthalmos.** Sovietskii Viestnik Opht., 1936, v. 9, pt. 5, p. 710.

A young man had enophthalmos of the left eye when in the upright position. On bringing the head down the eyeball came forward and exophthalmos appeared, and simultaneously the right side of the face became flushed. On resuming the upright position the exophthalmos persisted for one minute, after which the eye receded into the orbit again. The author attributes the phenomenon to disturbed sympathetic innervation. (Illustration.)
Ray K. Daily.

Muscatello, F. **Lipogranulomatosis of the orbit.** Rassegna Ital. d'Ottal., 1936, v. 5, Jan.-Feb., p. 108.

In a man of forty years, whose right eye had become increasingly exophthalmic for several months, the author removed a tumor the size of a small nut. Past history, physical and laboratory examinations shed no light on its nature. Histologically, it was seen to be composed of a network of firm, fibrous tissue, containing cells indicative of chronic inflammatory action. There were also areas containing much fat and certain cells full of small vacuoles, resembling xanthoma cells. Fat phagocytes were also seen. After discussion of the histopathologic picture and of the genesis of the tumor, the author concludes that the case was one of lipogranuloma, probably due to special vulnerability of the fat to hormone dysfunction. This is only the second case of such nature described in the literature. (6 figures.) Eugene M. Blake.

Pascheff, C. **Symmetric syphilomas of the orbit.** Klin. M. f. Augenh., 1936, v. 97, Dec., p. 751.

A woman of 48 years with positive Wassermann reaction presented symmetric pseudotumors. The lower orbital margin of each eye was very much thickened, uneven, and painful to the touch, and a hard mass extended below each eyeball deep into the orbit, with swelling of the lids. The optic discs were atrophic, the pupils enlarged and without reaction to light, and vision was almost abolished. An excised piece of the tumor showed fibrous tissue, with abundant thickened and obliterated vessels. There were foci containing numerous lymphocytes, plasma cells, and adventitial endothelial and giant cells, but nowhere spirochetes. These changes and speedy recovery under specific treatment confirmed the diagnosis of gummas of the orbit. (Illustration.) C. Zimmermann.

Riad, M. **A case of septic thrombosis of the cavernous sinus.** Bull. Ophth. Soc. Egypt, 1935, v. 28, p. 226.

The cavernous thrombosis was secondary to a purulent infection of the left orbit. Swelling of the nerve heads did not occur until several days after grave cerebral and toxic symptoms had appeared. Edna M. Reynolds.

Samuels, Bernard. **Dermoid cysts of the orbit.** Arch. of Ophth., 1936, v. 16, Nov., pp. 776-782; also Trans. Amer. Ophth. Soc., 1936, v. 34, p. 226.

This cyst, which usually occurs in the upper temporal part of the orbit, is very rare. The author has examined microscopically thirteen of various sizes and ages. Twelve of these are briefly summarized, and the thirteenth is described in detail and illustrated by photomicrographs. J. Hewitt Judd.

Schubert, G. **Observations on the oxygen content of the blood and on the blood circulation of the eye, by exposure to a photoelectric cell.** Graefe's Arch., 1936, v. 135, p. 558.

For spectroscopy of the hemoglobin in the living eye, Kahn's method is used. The eyeball of an albinotic rabbit is dislocated before the eyelids. Lang's scleral lamp is placed before the equator of the eyeball and Lang's selenium photocell, type S K, is placed before the dilated pupil. The clips of the photocell are connected with a mirror galvanometer after Duprez's method. As a result of the linear increase of the light with the strength of illumination, there occur changes in the electric current in the galvanometer, moving the light reflected from the mirror along a scale divided into 100 parts, thus giving direct percentages. The changes of oxygen concentration in the blood circulating in the eyeball are produced by artificial ventilation with a tracheal cannula in a curarized animal. Diminution of oxygen content causes diminution in intensity of the current of light; diminution of circulation causes increase in the light current. The method is offered as basis for development of a procedure for studying the retinal circulation in the human eye.
H. D. Lamb.

Volokitenko, A. E. **A case of pulsating exophthalmos.** Sovietskii Viestnik Opht., 1936, v. 9, pt. 5, p. 703.

A report of a case of arteriovenous aneurism between the ophthalmic artery and the ophthalmic sinus, in a patient with cardiovascular disturbances. Hard labor was the trigger which set off the disturbance. The case was treated by ligature of the common carotid artery and the internal jugular vein. The pulsation ceased, but the exophthalmos persisted.

Ray K. Daily.

Wright, J. H. **Aneurismal varix of the carotid.** Chinese Med. Jour., 1936, v. 50, Oct., p. 1506.

After a blow on the left parietal region, a 26-year-old male complained of a blowing noise in his left ear synchronized with his pulse. Exophthalmos developed in two weeks and a diagnosis of aneurismal varix of carotid artery and cavernous sinus was made. Ligation of the left common carotid artery cured the symptoms.

Lawrence G. Dunlap.

14

EYELIDS AND LACRIMAL APPARATUS

Ascher. **Longitudinal and transverse sutures of the lacrimal canaliculi. Suture of the upper canaliculus.** Klin. M. f. Augenh., 1936, v. 97, Dec., p. 770.

A triangular wound of the left upper lid of a boy of six years separated the upper canaliculus near the punctum. The gap in the canaliculus was closed by a transverse suture according to Elschnig (introduction of a thin fishbone or gutta-percha probe). After six days the canaliculus was permeable. Primary suture of the torn canaliculus must be aimed at under all circumstances, as later restoration is of essentially unfavorable prognosis.

C. Zimmermann.

Busacca, Archimede. **A method for correction of entropion in trachomatous patients.** Arch. of Ophth., 1936, v. 16, Nov., pp. 822-828.

An incision parallel to the free margin of the lid is made 5 mm. above it. The skin is undermined and the muscle incised at the level of the superior margin of the tarsus and just above the cilia. This part of the muscle is then removed and a linear incision is made on the tarsus about 5 to 8 mm. from and parallel to the free border of the lid. Thin slices are removed from the tarsus, forming a small, furrow-like incision. The inferior lip is then sutured to the superior side of the tarsal flap and then through the skin above. (Drawings.)

J. Hewitt Judd.

Cardello, Giovanni. **Doubling of the lower lacrimal canal.** Rassegna Ital. d'Ottal., 1936, v. 5, July-Aug., p. 481.

A case of double canaliculus in the left lower lid is described by Cardello. The adventitious canal opened a little internal and posterior to the normal punctum, and was very superficially placed, so that a probe was easily seen through the thin covering. Pressure upon the lacrimal sac caused regurgitation of mucus, the greater portion being expelled through the supernumerary opening.

Eugene M. Blake.

Cardello, G. **Plasmoma of the lacrimal sac.** Rassegna Ital. d'Ottal., 1936, v. 5, March-April, p. 238.

Cardello presents a review of our knowledge regarding the origin of plasma cells and the conditions in which they are met. He then describes three cases of plasmoma encountered in histologic study of 55 extirpated lacrimal sacs, almost all of which showed abundance of plasma cells in the inflammatory exudate. He concludes that in the three cases of plasmoma of the sac the plasma cells were purely an expression of inflammatory hyperplasia. (8 figures.)

Eugene M. Blake.

Fain, I. E. **On the need of testing of corneal sensitivity in operations on congenital ptosis.** Sovietskii Viestnik Opht., 1936, v. 9, pt. 6, p. 905.

A report of a case of keratitis due to corneal insensitivity complicating a Hess operation for congenital ptosis.

Ray K. Daily.

Goddard, F. W. **A satisfactory operation for entropion of the upper lid.** Chinese Med. Jour., 1936, v. 50, Oct., p. 1505.

The author describes an operation for upper lid entropion which he has found satisfactory in two hundred cases. Five to seven curved needles are passed between the skin and tarsus from the upper border of the tarsus to the ciliary margin of the lid. Then an incision is made through the entire thickness of the cartilage from one palpebral angle to the other, cutting down to the needles. The marginal portion is everted by pulling the needles through. The sutures are tied and left in a position of overcorrection for about ten days. Lawrence G. Dunlap.

Herman, E. **Unusual synkinesis of the lid.** Klinika Oczna, 1936, v. 14, pt. 6, p. 723.

A woman sixty years old treated for polycythemia was found, in the course of examination, to have paresis of the left externus and ptosis of the left lid on abduction. Looking straight ahead the lids were normal. The author attributes the dysfunction of the levator to its diminished tonus resulting from an influx of nerve impulses to the paretic externus. Ray K. Daily.

Iankevich, E. F. **Bilateral inflammation of the lacrimal glands.** Sovietskii Viestnik Opht., 1936, v. 9, pt. 5, p. 712.

Report of an acute case probably caused by malaria. Ray K. Daily.

Kolenko, A. B. **Mycosis of the lacrimal canals.** Sovietskii Viestnik Opht., 1936, v. 9, pt. 5, p. 643.

Review of the literature and report of a case. Recovery followed slitting of the canaliculi, curettage of their mucous membrane, and cauterization with iodine. The diagnosis was confirmed by inoculation into the conjunctiva and cornea of guinea pigs. Of six experimental animals inoculated, a positive reaction was obtained in the one animal which was pregnant. This supports the contention of those investigators who hold that pregnancy stimulates reactive processes within the organism.
Ray K. Daily.

Petterino Patriarca, A., and Duc, C. **Intranasal dacryocystorhinostomy.** Rassegna Ital. d'Ottal., 1936, v. 5, March-April, p. 205.

After historical review of the various operations of dacryocystorhinostomy, the authors report ten cases in which the intranasal technique was used. In all, including two cases of the phlegmonous type with fistula, rapid and complete healing resulted with permanent drainage. The authors prefer the intranasal method. The scalpel was used in every case to break down the osseous wall. It can be used in narrow nasal cavities where the trephine is impractical. (6 figures.)
Eugene M. Blake.

Ribnikova, O. I. **Amyloid degeneration of the lids.** Sovietskii Viestnik Opht., 1936, v. 9, pt. 6, p. 911.

Clinical and histologic report of a case. The histologic picture of involvement of the adventitial cells suggests a toxic irritation as the initial process. Section shows in some parts definite processes of irritation and in others remains of a proliferative process. A chronic toxicosis produces in the lids a reticulo-endothelial blockade with consequent loss of function. Inasmuch as the reticuloendothelium is the chief regulator of albumen metabolism its disturbance causes transformation of the albumen into amyloid.
Ray K. Daily.

Roy, J.-N. **Plastic surgery of the face, and mental hygiene.** Reprint from Proceedings of Assoc. of Physicians of the French Language of North America, 1937, Jan.

With two pages of text and a bibliography the author associates 26 pages of photographs of patients upon whom plastic surgery has been performed.
W. H. Crisp.

Towbin, B. G. **A surgical procedure in treatment of epiphora after extirpation of the tear sac.** Graefe's Arch., 1936, v. 135, p. 579; also Sovietskii Viestnik Opht., 1936, v. 9, pt. 5, p. 696.

The operation is a modification of that of Dupuy-Dutemps. Through an incision in the skin of the nose close to the nasal canthus, a small area of the

bony wall is removed and the nasal mucous membrane opened. A sound passed through the lower canaliculus pushes inward the cicatricial tissue formed after removal of the tear sac, so that it can be incised. Then the flaps of nasal mucous membrane are sutured to the end of the incised tissue continuous with the canaliculus. A long piece of thick thread is then passed on a straight short needle through the inferior punctum into the nose and its ends tied together on the face. The thread is not removed for ten or twelve days. H. D. Lamb.

15

TUMORS

Attiah, M. A. H., and Tobgy, A. F. **Incidence of malignant disease of eye and adnexa in Egypt.** Bull. Ophth. Soc. Egypt, 1935, v. 28, p. 208.

Ocular neoplasms are responsible for only a small percentage of eye disease in Egypt. Of 870 specimens 89 percent were extraocular. Commonest were epithelioma and rodent ulcer of the lids, and limbal epithelioma of the conjunctiva. Edna M. Reynolds.

Bussola, Ernesto. **Primary epithelioma of the limbus.** Rassegna Ital. d'Ottal., 1936, v. 5, July-Aug., p. 434.

The author describes two cases of primary epithelioma of the limbus with extension upon the cornea and conjunctiva. The clinical and histologic examinations place these tumors in the group of epithelial neoplasms. The first case, in a man of 55 years, falls in Poleff's classification as "initial epithelioma," and the second, in a man of 78 years, fits as "epithelial carcinoma." There follows a consideration of the characteristics of malignancy in epitheliomata. Eugene M. Blake.

Caocci, G. **Primary lymphosarcoma of the conjunctiva.** Rassegna Ital. d'Ottal., 1936, v. 5, Jan.-Feb., p. 55.

Caocci's patient was a farmer of 62 years who had observed a growth of the left lower lid four years previously. There was no evidence of recurrence for three years following excision of the growth. Swelling of the lid was then noticed and increased rapidly. The upper lid was invaded and movement of the globe greatly impeded. Biopsy demonstrated a tissue clearly malignant, so the orbit was exenterated. Histologic study showed lymphosarcoma. A careful microscopic report is followed by voluminous discussion of the other proliferative and neoplastic growths which occur in the conjunctiva, and which must be differentiated from true lymphosarcoma. Eugene M. Blake.

Hill, E., and Dart, R. O. **Cavernous hemangioma of the choroid.** Trans. Amer. Ophth. Soc., 1936, v. 34, p. 122.

This report of five classic examples of cavernous hemangioma of the choroid is complete with clinical history and examination, pathologic reports, and photomicrographs of each case. The case reports and microscopic sections are from the Registry of Ophthalmic Pathology, Army Medical Museum. The difficulty in clinical, preoperative diagnosis is emphasized. It is suggested that the condition would be more frequently seen if all eyes enucleated for glaucoma were examined microscopically. David Harrington.

Lemoine, A. N., and McLeod, John. **Bilateral metastatic carcinoma of the choroid; successful roentgen treatment of one eye.** Arch. of Ophth., 1936, v. 16, Nov., pp. 804-821; also Trans. Amer. Ophth. Soc., 1936, v. 34, p. 134.

The authors review the literature and tabulate the cases reported since Ask's list. A case of bilateral choroidal metastasis of carcinoma of the breast in a woman aged 72 years is reported, in which both metastatic tumors were observed almost from the time of initial lodgment of the emboli. Roentgen therapy was successful in restoring useful vision in the second eye, the left eye having been previously enucleated. Death ensued and the autopsy report is given in detail, together with the microscopic study of both eyes. These confirmed the clinical diagnosis. (Photomicrographs.) J. Hewitt Judd.

Martin, H. E., and Reese, A. B. **Treatment of retinal gliomas by the**

fractionated or divided-dose principle of roentgen radiation; a preliminary report. Arch. of Ophth., 1936, v. 16, Nov., pp. 733-761.

The cases reported in the literature which were treated by radiation are reviewed to show that a few small or massive doses of radiation are not reasonably successful. Since retinal glioma is radio-resistant, the technique employed included a highly fractionated but large total dose, using a small circular portal accurately directed on to the region of the growth. The treatment is continued over a long period, even up to twenty months. The clinical course and complications are discussed, and two of the six cases treated by this method are reported in detail and illustrated by fundus drawings. (Discussion.)

J. Hewitt Judd.

Merkulov, I. I. **Topography of Rous sarcoma in the eye.** Sovietskii Viestnik Opht., 1936, v. 9, pt. 6, p. 906.

This experimental study on chickens shows that metastasis of the Rous sarcoma takes place in the lungs, ovaries, liver, kidney, and heart in the order named. The topography of the metastasis is determined by physico-chemical and not by anatomic considerations. Repeated traumatism did not initiate metastasis. Ray K. Daily.

Moretti, Egisto. **A case of orbital reticuloma.** Rassegna Ital. d'Ottal., 1936, v. 5, July-Aug., p. 426.

After discussing the more modern terminology of tumors the author reports an orbital tumor in a woman of 34 years. Exophthalmos had been present for four years and had reached a height of 2 cm. A portion of the tumor removed for study showed a neoplastic growth, part of which suggested mesenchymal structure and part epithelial. There was a delicate reticular stroma containing an amorphous substance, and many small cavities. Cells with large nuclei and chromatin network were frequent. In some portions of the growth were numerous tubular cavities of large size lined by one or two layers of cells with abundant protoplasm, suggesting adenocarcinoma. The diagnosis was "reticuloma with pseudotubuloepithelial aspects."

Eugene M. Blake.

Rönström, Hjalmar. **A case of retinal glioma treated with X rays and observed for twelve years.** Acta Ophth., 1936, v. 14, pts. 3-4, p. 361.

The left eye had been enucleated for glioma when the child was seventeen months old. The mother of the child had had both eyes enucleated for glioma. Twelve years after being treated with heavy doses of X rays, the child's right eye, with several foci suggestive of neoplasm in the fundus, had normal vision. The author reports briefly another case treated similarly but unsuccessfully. Ray K. Daily.

Siegrist, A. **A new route for the transfer of glioma cells from one eye to the other.** Schweiz. med. Woch., 1936, no. 47, Nov. 21, p. 435.

In three patients, all under four years of age, transfer of glioma cells from one eye to the other was substantiated by sections showing the cells in the intervaginal spaces of the optic nerve. Thus Leber's theory concerning the route for infection in sympathetic ophthalmia may have a real basis.

Theodore M. Shapira.

Testa, Ugo. **Tumor of the plica semilunaris with gland formation.** Rassegna Ital. d'Ottal., 1936, v. 5, July-Aug., p. 489.

A tumor, the size of a pea, was found arising from the plica semilunaris of the right eye of a 52-year-old woman. It was pedunculated and smooth and not connected with caruncle or conjunctiva. Histologically it was an angiofibroma and showed well formed glands of the type of Krause's glands. A good review of the tumors found in the plica adds to the value of the case report. (6 figures.) Eugene M. Blake.

Tristaino, Leonardo. **Epibulbar reticulo-endothelioma.** Rassegna Ital. d'Ottal., 1936, v. 5, July-Aug., p. 395.

In the case described by Tristaino a 64-year-old man presented an epibulbar tumor of the left eye, stated to be the

first reticulo-endothelioma described in this situation. Twenty years before the tumor was removed the patient had had transplantation of a pterygium on each eye and the tumor had first developed at the site of the transplanted head. The mass projected from the lid margin and completely replaced the cornea. It was hard and bled easily. Enucleation being refused, the tumor was excised. Histologically it was composed of new-formed tissue, of an adult-connective-tissue type and morphologically malignant, and the whole is described as a blastomatous process. There was atypical multiplication of cells with a collagenous stroma, almost like a process of repair. The inflammatory cells were probably the result of the chronic reaction of the tissues. The cells described as blastomatous were considered to be derived from the reticulo-endothelial cells.

Eugene M. Blake.

16
INJURIES

Baskakov, K. F. **Prolonged retention of a foreign body in the supero-external angle of the orbit.** Sovietskii Viestnik Opht., 1936, v. 9, pt. 6, p. 918.

A piece of wood remained encapsulated in the superior external part of the orbit for three years. It caused inflammatory conjunctivitis and scleritis, which subsided promptly on removal of the foreign body. Ray K. Daily.

Bushmich, D. G. **Pigmentation of the conjunctiva of the eyeball in a perforating injury of the sclera with partial loss of the iris.** Sovietskii Viestnik Opht., 1936, v. 9, pt. 5, p. 698.

The author adds another case to fifteen reported in the literature. A twelve-year-old boy sustained a perforating ocular injury with subconjunctival dislocation of a portion of the iris and subsequent pigmentation of the overlying conjunctiva. Ray K. Daily.

Clegg, J. G., and Moore, F. C. **A case of bilateral ganglionic neurogliomata of the face.** Brit. Jour. Ophth., 1937, v. 21, Feb., pp. 92-94.

This record is repeated because of the rarity of the condition and the fact that the Medical Chronicle of 1900 carrying the original report is now extinct. The patient was a baby aged nine months, with good family history. Both tumors were excised with excellent results. Such tumors are generally regarded as arising from the brain or some part of the central nervous system. In the case reported it was believed that they were due to the olfactory lobes being protruded through fissures of the skull at birth (a hydrocephalic condition existing) and ultimate constriction. D. F. Harbridge.

Farino, Ferdinando. **Traumatic interstitial keratitis in one eye, extending to the other.** Rassegna Ital. d'Ottal., 1936, v. 5, May-June, p. 362.

Farino reports a case, much contested legally, of interstitial keratitis in one eye following injury by a drop of hot varnish. The patient was 21 years old and syphilitic. After an unstated interval of time, the second eye developed the same condition, without having been injured. The eye first affected cleared up with vision of 9/10 but the second eye was more damaged and its final vision was only 1/50. The court of appeals ruled that the loss of vision in the second eye was due to the injury to the first and awarded compensation on that basis. Eugene M. Blake.

Friedman, S. I. **Construction of a solenoid giant magnet.** Sovietskii Viestnik Opht., 1936, v. 9, pt. 6, p. 858.

Description of a Soviet-manufactured giant magnet. Ray K. Daily.

Hagedoorn, A. **Choroidal tears.** Amer. Jour. Ophth., 1937, v. 20, Jan., pp. 13-15.

Iofe, Z. M. **Injury to the retina in motion-picture photography.** Sovietskii Viestnik Opht., 1936, v. 9, pt. 6, p. 882.

A report of three cases of electric retinitis, similar to that found in solar retinitis, in arc-light engineers. The author urges proper protective regulations. Ray K. Daily.

Ling, M. H. **Penetrating wound of orbit and ethmoid.** Chinese Med. Jour., 1936, v. 50, Oct., pp. 1502-1504.

A piece of ebony chopstick 9.5 cm. long and 0.5 cm. in diameter was thrust through the lower lid, orbit, and ethmoid to a depth of about 7 cm. It was immediately removed and there resulted no proptosis, impairment of vision, or interference with normal ocular movements. Lawrence G. Dunlap.

Lugli, Luigi. **Vossius' ring.** Soc. Oft. Ital., 1934. Reprint in Saggi di Oft., 1934-1936, v. 8.

The ring, in a nineteen-year-old laborer, followed a contused wound of the left eye. There were tears in the sphincter and the iris stroma, but no central opacity of the lens. There was gradual and complete disappearance of the granules composing the ring, and vision returned to normal. The author discusses the theories of Hesse and of Vogt regarding the manner of production of the ring, and concludes that it is caused by fixation of pigment granules from the inner surface of the sphincter iridis upon the lens capsule, but that a specific lesion to the capsule is produced at the moment of sharp contact of the pupillary border with the lens. (One figure.)

Eugene M. Blake.

Luo, T. H. **Chorioretinitis sclopetaria.** Chinese Med. Jour., 1936, v. 50, Oct., pp. 1405-1408.

Eyeground changes following gunshot injuries of the orbit are described as (1) immediate free bleeding into the vitreous causing an obscured fundus) and (2) remote (hemorrhages preretinal, retinal and behind the retina, and whitish patches involving wide areas at different parts of the fundus).

Lawrence G. Dunlap.

Marucci, Luigi. **Four cases of traumatic myopia.** Rassegna Ital. d'Ottal., 1936, v. 5, May-June, p. 327.

In each of the four cases of traumatic myopia observed by Marucci, the cause was contusion of the globe. There was final reduction in the amount of myopia in all cases and a complete disappearance in one. In three cases the amount was not more than four diopters, and in one it was ten. Mydriasis was observed in all cases and fundus changes in two. In the first case the myopia was believed to be due to hypotony or spasm of the ciliary muscle together with subluxation of the lens. After a few days glaucoma supervened and eventually an iridosclerectomy was done. That spasm of the ciliary muscle was the cause in at least one case was proved by the fact that eserin induced a still greater amount of myopia. The small residual myopia remaining in two cases was perhaps caused by weakening of the zonular fibers. Eugene M. Blake.

Motolese, Francesco. **Two interesting observations of traumatic panophthalmitis and uveitis of rapid evolution.** Boll. d'Ocul., 1936, v. 15, Oct., pp. 1023-1034.

A woman of 54 years, wounded by a sickle, showed a penetrating wound of the left cornea with marked iris prolapse and cataract. Two days later symptoms of panophthalmitis manifested themselves. Bacteriologic examination of the contents of the eviscerated eye showed Bacillus subtilis. A boy of four years, wounded by a piece of wood, showed a penetrating wound at the upper limbus of the left eye. This eye was enucleated fourteen days later. Bacteriologic examination of the intraocular contents showed Bacillus subtilis and Micrococcus pyogenes citreus. (Bibliography.)

M. Lombardo.

Sédan, Jean. **Necrosis of the tarsus from copper sulphate stick having remained in the upper cul-de-sac for twelve days.** Rev. Internat. du Trachome, 1936, v. 13, July, p. 133.

This rare accident is reported in a patient who was treating himself.

J. Wesley McKinney.

Shelgunov, V. P. **Electromagnetic operations in the data of the Beshiza city hospital.** Sovietskii Viestnik Opht., 1936, v. 9, pt. 5, p. 674.

A detailed study of intraocular-

foreign-body cases treated within the last five years in this five-hundred-bed industrial hospital, with clinic facilities for two thousand patients. The conclusions are that electromagnetic extraction is an emergency operation and electromagnetic facilities should be a part of every ophthalmologic service. With this objective the "Red Profintern Industry" constructed an electromagnet equal in efficiency to the imported types. There were no infections in 41 extractions performed within the first two days after injury. Ray K. Daily.

17

SYSTEMIC DISEASES AND PARASITES

Attiah, M. A. H. **The frequency of ocular manifestations of diabetes.** Bull. Ophth. Soc. Egypt, 1935, v. 28, p. 201.

The eyes of 135 diabetics between the ages of twelve and seventy years were examined. Ocular manifestations were found in only 35, or 26 percent. The most severe cases of ocular diabetes occurred in the younger patients. Of 22 cases of cataract seen among the 135 diabetics, only six could be called true diabetic cataracts.

Edna M. Reynolds.

Attiah, M. A. H., and Tobgy, A. F. **Ocular tuberculosis in Egypt.** Bull. Ophth. Soc. Egypt, 1935, v. 28, p. 137.

In two cases of keratitis and three cases of iridocyclitis of tuberculous origin there was no active pulmonary tuberculosis and treatment with tuberculin gave satisfactory results. The basis of the tuberculin test and its technique are reviewed. Lung tuberculosis occurs in Egypt in about the same proportion as in other countries, so there is no reason why eye tuberculosis should not be as frequent there as elsewhere. That few cases are reported the author ascribes to the omission of diagnostic tests. Edna M. Reynolds.

Caramazza, Filippo. **Research considerations of ocular tuberculosis.** Soc. Oft. Ital., 1934. Reprint in Saggi di Oft., 1934-1936, v. 8.

By inoculating into the peritracheal glands of guinea pigs aqueous withdrawn from the eye of a rabbit suffering from lesions produced by injection of human tubercle bacilli, the author was able to produce tuberculous glandular lesions. Passage of material from these glands set up similar lesions in a second guinea pig, involving lymphatic glands, spleen, and liver. Virulent germs introduced into the anterior chamber produced a more precocious and severe form of iritis, both diffuse and with tubercles. Use of attenuated organisms evoked a much less severe reaction, sometimes resulting in chronic subacute iritis with synechiae, pigmentary changes, and iris atrophy. In the posterior segment of the eye there developed a choroiditis without tubercles but with much pigment proliferation. Inoculation into the vitreous usually led to retinal or chorioretinal changes with late and slight iris involvement. The first evidence of tuberculous change in the iris was dilatation of the vessels of the major circle, with elevation of the stroma. Pigment proliferation soon followed.

Eugene M. Blake.

Goldfeder, A. E., and Kipelovich, M. A. **Diabetes and the eye.** Sovietskii Viestnik Opht., 1936, v. 9, pt. 6, p. 798.

A study of the ocular changes in five hundred diabetics. In 53 percent the ocular tension was at the lower level of normal. In 70.6 percent there was deficient accommodation. Changes in refraction were found in 69 of 100 carefully refracted cases. Diabetic cataracts were found in 3.5 percent, retinitis in 1.8 percent, xanthelasma in 1.4 percent, paralysis of the abducens in one case, weakness of convergence in 35.1 percent, Graefe, Stellwagen and Dalrymple signs in 6.6 percent, and anisocoria in 14.1 percent. Ray K. Daily.

Halbron, P. **Ophthalmic sequelae of radical treatment of fronto-ethmoidal sinusitis.** Arch. d'Opht., 1936, v. 53, Dec., p. 861.

Radical treatment in this disease may affect the motility of the globe, the lacrimal passages, the lids, or the globe. While the action of the superior oblique is most often interfered with, other ocu-

lar muscles are frequently thrown out of balance. Four such cases are reported. The diplopia may disappear spontaneously, therefore surgery must not be done too soon. In order to prevent corneo-conjunctival complications much care should be exercised in bandaging the eyes so that the lids are closed. This may be difficult because of exophthalmos due to orbital cellulitis or hemorrhage which may be present. (Charts, bibliography.) Derrick Vail.

Hou, H. C. **The relation of vitamin A to health and disease.** Chinese Med. Jour., 1936, v. 50, Oct., pp. 1481-1492.

A complete review concerning vitamin A with three pages of bibliography and six plates. Lawrence G. Dunlap.

Hrom, Stanislav. **Endocrinology and the eye.** Klinika Oczna, 1936, v. 14, pt. 6, p. 748.

A review of the literature with the following conclusions: The endocrine glands have a definite effect on ocular pathology. Since there are no ocular symptoms characteristic of endocrine disturbance an endocrinologic examination is indicated in all ocular diseases. Present methods of examination do not afford a definite etiologic diagnosis. Ocular affections of thyroid or pancreatic disturbances have the best prognosis. It is probable that ocular disturbances are caused by an endocrine syndrome rather than by a disturbance in one gland, and this explains why different authors attribute the same ocular symptoms to various glandular disturbances. Ray K. Daily.

Lazar, N. K. **Early ocular complications of epidemic meningitis.** Arch. of Ophth., 1936, v. 16, Nov., pp. 847-853. Also Trans. Sec. on Ophth. Amer. Med. Assoc., 1936, 87th annual meeting.

During epidemics in 1933, 1934, and 1935 ocular complications were observed in 575 cases. These are discussed and tabulated. Several cases are reported in detail to show that these complications are due to infection of the blood stream. Two major ocular complications observed were endophthalmitis and paresis of the external rectus muscle. Unless treated very early, the antitoxin has little effect on the ocular complications, but it greatly reduces the number of ocular complications. Microscopic examination of the eyes from two cases of endophthalmitis from epidemic meningitis showed nothing to distinguish it from other blood-born infections. (Discussion.)

J. Hewitt Judd.

Lucheri, Giovanni. **Tryptophane in ocular diseases of constitutional origin.** Rassegna Ital. d'Ottal., 1936, v. 5, May-June, p. 354.

The author's researches concerning the presence of tryptophane in the blood in constitutional eye diseases suggest the following conclusions: (1) In trachoma there is usually an increase, particularly in cases of a demonstrably lymphatic type. (2) Except in the secondary form of glaucoma, there is usually a protein disequilibrium. (3) In phlyctenular disease the albumen-globulin relation is generally altered, the tryptophane being above normal. (4) Increase of tryptophane varies pari passu with the increase in velocity of sedimentation of the blood. The study attempts to place our knowledge of the relationship between disordered physiology and ophthalmic pathology on a more scientific basis.

Eugene M. Blake.

Marzio, Quirino di. **Tuberculosis of the eye.** (Extract from the volume "La tubercolosi extrapolmonare," published by A. Wassermann and Company, Milan.) Reprint in Saggi di Oft., 1934-1936, v. 8.

This instructive review of our knowledge of tuberculosis of every part of the eye contains also the results of many careful animal experiments. Its 60 pages are beautifully illustrated by 25 figures, mostly in color. The article is too comprehensive for abstracting.

Eugene M. Blake.

Melik-Musian, B. H. **Echinococcus of the orbit.** Sovietskii Viestnik Opht., 1936, v. 9, pt. 5, p. 714.

Report of a case of retrobulbar neo-

plasm which at operation was found to be an echinococcus cyst. (Illustration.) Ray K. Daily.

Mielke, S. **Capillary hemorrhages in the nail bed of persons with eye diseases.** Arch. f. Augenh., 1936, v. 110, Dec., p. 236.

With the capillary microscope capillary hemorrhages were found in 83 out of 175 cases. Their frequency does not go strictly parallel with increase of age, although arteriosclerosis plays an important part. Hemorrhages were found conspicuously often in higher myopia (especially in cases accompanied by degenerative changes) and in young persons with paresis of eye muscles. In inflammatory diseases and in glaucoma the hemorrhages were not so frequent, although the number of glaucoma patients examined was too small for definite conclusions. R. Grunfeld.

Mohamed, I. A. **Allergy in ocular diseases.** Bull. Ophth. Soc. Egypt, 1935, v. 28, p. 153.

Allergy to tuberculosis is discussed in detail. The hematogenous origin of ocular tuberculosis is emphasized as well as the fact that the primary focus is almost always a slight healed pulmonary infection. Tebeprotein is recommended for diagnosis and treatment because it contains specific tuberculous protein. The technique of its use is given in full. Edna M. Reynolds.

Pergola, Alfredo. **Eye changes in xeroderma pigmentosum.** Rassegna Ital. d'Ottal., 1936, v. 5, May-June, p. 291.

Pergola presents in tabular form a review of 56 cases to be added to the sixty collected by Alaymo in 1933. He then adds the case histories of three young boys affected with this disease, two brothers and one a cousin of the other two. A maternal grandfather also had been affected. Each showed evidence of the condition shortly after birth and each had had some exanthematous disease. The author feels that the short waves in sunlight usually play a definite part in development of the skin lesions, but this factor can be excluded in his cases. He then raises the question whether some disturbance of endocrine function may not be involved, especially defective thyroid action. (3 figures.) Eugene M. Blake.

Wagener, H. P., and Weir, J. F. **Ocular lesions associated with postoperative and gestational nutritional deficiency.** Amer. Jour. Ophth., 1937, v. 20, March, pp. 253-259; also Trans. Amer. Ophth. Soc., 1936, v. 34, p. 174.

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HYGIENE, SOCIOLOGY, EDUCATION, HISTORY

Adams, A. L., Gamble, R. C., Gifford, S. R., and Gradle, H. S. **A second ophthalmological survey of the Illinois State School for the Blind.** Amer. Jour. Ophth., 1937, v. 20, Jan., pp. 60-61.

Bader, A. **Further unknown letters of ophthalmologists from 1856 to 1885 from Horner's estate.** Klin. M. f. Augenh., 1936, v. 97, Dec., p. 787.

Ballantyne, A. J. **The Tennent chair and the Tennent Memorial Institute of Ophthalmology, Glasgow.** Arch. of Ophth., 1936, v. 16, Dec., pp. 927-930.

A short history of the founding of the institution is given, together with a description of the building, its arrangement and equipment.

J. Hewitt Judd.

Brück, A. J. **Trachoma in Palestine.** Rev. Internat. du Trachome, 1936, v. 13, April, p. 98.

The author examined one whole Arab village, and all the pupils of two schools in Caiffa and one school in Jerusalem. He reports his findings as to trachoma.

J. Wesley McKinney.

Busacca, Archimede. **Impressions and statistics on trachoma in the state of São Paulo.** Folia Clin. et Biol., 1936, v. 8, no. 5, p. 140.

Busacca thinks that trachoma was introduced into Brazil by the first settlers, and not by the Italian wave of immigration in 1889, as is generally believed. The disease tends to be mild in

his country, a benign "abortive" form being frequently seen. Statistics about frequency are difficult to evaluate. Out of 1,404 private patients 7 percent had trachoma and out of 1,508 clinic patients 22 percent had trachoma. The incidence is highest in the third decade of life. As cause of blindness, trachoma occupies a secondary place in Brazil.

F. A. Wies.

Cadéot, Robert. **Segregation of the trachomatous from the troops of Tunis.** Rev. Internat. du Trachome, 1936, v. 2, April, p. 104.

A report of organization and results of treatment among Tunisian troops.

J. Wesley McKinney.

Carns. **Trachoma among the Algerian regiments of the capital.** Rev. Internat. du Trachome, 1936, v. 2, July, p. 137.

A survey.

Cuénod, A. **Charles Nicolle.** Rev. Internat. du Trachome, 1936, v. 2, April, p. 61.

An obituary.

Delanoë, E. **Antitrachomatous prophylaxis among indigenous Moroccans,** etc. etc. Rev. Internat. du Trachome, 1936, v. 2, July, p. 142.

Energetic prophylaxis for ten years has lowered by one-half the number of cases. J. Wesley McKinney.

Ferree, C. E., and Rand, G. **Requirements of good desk lighting.** Amer. Jour. Ophth., 1937, v. 20, March, pp. 286-292.

Harroy. **The fight against trachoma in the family in Tunis.** Rev. Internat. du Trachome, 1936, v. 2, April, p. 118.

How trachoma is combated in Tunis.

Kraupa, E. **Eduard von Jaeger's views on the making of theories as an end in itself.** Zeit. f. Augenh., 1936, v. 90, Dec., p. 310.

Kraupa quotes a page from Jaeger's ophthalmoscopic atlas of 1869 in which he deplores the publication of fabricated theories and unsubstantiated opinions. He also points out that an easy way to appear brilliant, informed, and progressive is to publish the chance inspiration of a happy moment in the form of "a preliminary report" which can be followed by a more extensive paper and innumerable modifications in the form of "supplementary remarks." When a new theme becomes fashionable, a new series of papers can be initiated with a preliminary report. Kraupa's only comment is "a hard but just condemnation of the pseudo-activity of certain medico-scientific manufacturers."

F. Herbert Haessler.

Lebensohn, J. E. **The history of ophthalmology.** Amer. Jour. Ophth., 1937, v. 20, Feb., pp. 183-184.

Librowicz, M. **Impressions of the Czech eye clinic in Prague.** Klinika Oczna, 1936, v. 14, pt. 6, p. 785.

The author spent a year and was very cordially treated at Dr. Kadlicky's clinic, which provides ophthalmologic training for Czech ophthalmologists. After four years of full time training they are ready for private practice and leave the clinic to make room for the younger men. The surgical service is very large, and operations largely practiced are intracapsular extraction, diathermy coagulation for retinal detachment, cyclodialysis for glaucoma, and extirpation of the lacrimal sacs and glands. Ray K. Daily.

Litinskii, G. A. **Marksmanship and its relation to the dominant eye and to aiming with both eyes open.** Sovietskii Viestnik Opht., 1936, v. 9, pt. 6, p. 870.

This is a report of a study to determine whether the dominant or the nondominant eye is more suitable for aiming in shooting, and whether the aim is better with one eye shut or with both eyes open. The findings are that in the majority of cases the marksmanship is better in the dominant eye, and that it improves with both eyes open. The aiming acuity of the nondominant eye improves in fifty percent of cases when aiming with both eyes open, although in some cases the open dominant eye creates confusion for the other eye.

Ray K. Daily.

Marzio, Quirino di. **Didactic, clinical, and scientific activities.** Reprint in Saggi di Oft., 1934-1936, v. 8.

This report of 61 pages describes the di Marzio clinic at Bologna, and the teaching, investigations, and publications of the members of the staff.

Eugene M. Blake.

Melanowski, T. **The fight on trachoma in the Wilno district.** Klinika Oczna, 1936, v. 14, pt. 5, p. 701.

The present facilities for the treatment of trachoma are totally inadequate, and additional dispensaries and nurses will be necessary in order to reduce the high prevalence of the disease.

Ray K. Daily.

Melanowski, W. H. **Impressions of the fifth Czecho-Slovak Medical Meeting in Sofia.** Klinika Oczna, 1936, v. 14, pt. 5, p. 646.

Among the interesting presentations in the section of ophthalmology were Gala's discussion of the vitamin-C content of the anterior chamber in health and disease, Niczeticz's report of corneal transplantation of transparent corneas of cadavers, and Teisler's demonstration of celluloid contact glasses. Ray K. Daily.

Pi, H. T. **Trachoma in China.** Chinese Med. Jour., 1936, v. 50, Oct., pp. 1465-1480.

Pi gives a thoroughly complete discussion of trachoma in China, where it has apparently existed for the past 4,600 years, having supposedly come from Egypt. It is found all over China and at least one-third of the whole population suffers from it, but it is more prevalent in dry, dusty north China. One-fourth of the cases are mild, one-half moderately severe, and one-fourth severe. Lawrence G. Dunlap.

Rostkowski, Louis. **The campaign against blindness in Poland.** Folia Ophth. Orientalia, 1936, v. 2, Oct., p. 239. (See Amer. Jour. Ophth., 1937, v. 20, Feb., p. 234.)

Silva, Rafael. **Eulogy to Dr. Daniel M. Velez.** Anales Soc. Mexicana de Oft. y Oto-Rino-Laring., 1936, v. 11, July-Sept., pp. 3-9.

The eulogy is followed by a three-page list of the writings of Velez.

The Social Security Act and the blind. Outlook for the Blind, 1936, v. 30, Oct., p. 148.

Since the Social Security Act went into effect, the measures for the relief of the blind in the several states have undergone changes in order to put the state acts and the federal act in accord. In most cases where the reports are available, the service of financial aid to the blind has been turned over to the committees which give financial aid to persons with sight.

The consensus of opinion, generally, is that the program is not so satisfactory as it was formerly. Then financial aid for the blind was carried on along with medical, vocational, and employment service. The article includes letters from executive boards which deal with aid to the blind. Most of the boards expect the Social Security Act to increase the help given the blind. They admit that the red tape involved at the present time is holding back the desired results. On the other hand, the general opinion of the people receiving blind pensions is that they have been mistreated. If they have any way of earning part of their living, they cannot receive aid as they formerly did.

M. E. Marcove.

Strebel, J. **Constellation pathology and ophthalmology.** Klin. M. f. Augenh., 1936, v. 97, Dec., p. 777.

This paper analyzes the conception of etiology on the basis of mathematical formulae analogous to those of crystals and minerals, whose structural forms can be calculated.

C. Zimmermann.

Whitfield, Ernest A. **Thoughts for blind musicians.** Outlook for the Blind, 1936, v. 30, Oct., p. 140.

There is no connection between blindness and musical ability. The author suggests that the blind person must have a true talent for music if he is to undertake it as his life work. Then

he must spend far more time in studying than a person who has vision. The study should include more than one branch of the profession; that is, an organist should be able to teach music or to lecture as well as play the organ. Hobbies, to help make social contacts, are advisable. Especially to be stressed are general education, business sense, and a presentable appearance at all times. M. E. Marcove.

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ANATOMY, EMBRYOLOGY, AND COMPARATIVE OPHTHALMOLOGY

Hagedoorn, A. **Comparative anatomy of the eye.** Arch. of Ophth., 1936, v. 16, Nov., pp. 783-803.

This article considers the development of the anterior segment and its significance for the development of the vertebrate eye as a whole; the causal development of the lens and of the eye; the brain eye of amphioxus; the "origin" of the eye in vertebrates; the eyes of invertebrates and vertebrates; neurobiotaxis; and the gradual evolution of the eye in the invertebrates and its sudden appearance in vertebrates. (Numerous illustrations.) J. Hewitt Judd.

Schmerl, E. **The influence of crystalline lens as food on growth phenomena from experiments on tadpoles.** Folia Ophth. Orientalia, 1936, v. 2, Oct., p. 228.

While feeding tadpoles with crystalline lens, retina, and cornea the author made the following observations. The growth of the tadpoles was considerably increased when fed with lenses. The lens material was suspended in the water tank in a celluloid sack. The increased growth is attributable to a compensatory mechanism. Lens material is a highly oxidizing substance, and by exhausting the oxygen in the tank it caused the tadpoles to suffer from anoxemia. As a compensation the hearts of the tadpoles grew to thrice their normal size, the whole vascular system became hypertrophic, and the gills seemed to be hyperemic. This experiment throws some light on the common observation that aphakic eyes in the young remain retarded in their growth, lacking the growth-promoting factor of the lens. Tadpoles fed with iris became richer in chromatophores. Most likely the yellow pigment present in the iris is the factor which promotes development of chromatophores.
R. Grunfeld.

Siotto, G. **Relations of the veins of the maxillary sinus and orbit.** Rassegna Ital. d'Ottal., 1936, v. 5, March-April, p. 270.

Siotto gives a valuable picture of the developmental and anatomic relationships between maxillary sinus and orbit. The floor of the sinus may contain many small foramina, the "cribrum." Sometimes a canal runs from the upper teeth to the floor of the orbit, developed from connections betwen first and second dentitions. Thus are explained many pathologic processes which extend from teeth to antrum and thence to the orbit. Involvement of the orbit in maxillary disease may occur in three ways: (1) direct extension through the bony wall; (2) by means of lymphatic vessels; (3) by any of the veins. The author considers the veins the most frequent avenues for extension from the mucous membrane of the antrum to the orbit. (5 full-page plates.)
Eugene M. Blake.

NEWS ITEMS

Edited by Dr. H. Rommel Hildreth
640 S. Kingshighway, St. Louis

News items should reach the Editor by the twelfth of the month

Miscellaneous

At the request of a group of delegates to the Madrid Congress in 1933, the Farley Travel Agency has prepared two itineraries for doctors intending attendance at the 15th International Congress of Ophthalmology, which will be held in Cairo, Egypt, December 8-14, 1937.

The first itinerary extends from November 23d to January 5th, sailing from and arriving in New York City. Adequate time for sightseeing will be had in the Azores, Marseilles, Naples, Alexandria, Cairo, Athens, Rome, and Genoa.

The second trip starts in New York on November 20th and ends in New York on December 30th. After two days in Naples the trip continues to Egypt, stopping at Alexandria, Cairo, and Luxor. Two days are spent in Palestine, then back to Naples and New York.

Detailed information may be had by writing to Miss Yvonne L. duPeyron of the Farley Travel Agency, 535 Fifth Avenue, New York City.

The American Board of Ophthalmology will conduct an examination in Philadelphia, June 7, 1937, and in Chicago, October 9, 1937. All applications and case reports, in duplicate, must be filed at least 60 days before the date of examination.

The American Board of Ophthalmology has decided to establish a Preparatory Group of prospective candidates for its certificate, the plan being to assist physicians who wish to study ophthalmology so that they may become acceptable as candidates for examination and certification when they have completed the requirements.

Any graduate or undergraduate of an approved medical school is eligible to make application for membership in this group. Candidates so applying will be notified officially by the Secretary when the Board has accepted their applications. If accepted, data will be sent concerning ethical and educational requirements. Syllabuses and other information will be made available to them.

Information and advice will be available to members in this group through preceptors who are members or associates of the Board. Members of the Preparatory Group must keep a summarized record of their activities, two copies of which will be sent to the Secretary in January of each year and will be incorporated in the final application for examination and certification.

The fee for application for membership in the Preparatory Group will be $10.00. This will be deducted from the $50.00 which is required of every candidate for examination. John Green, M.D., Secretary, 3720 Washington Blvd., St. Louis, Mo.

On or about May 1st, the Soft-Lite Lens Company will have completed the process of moving to their new offices in the Squibb Building at 745 Fifth Avenue, New York City—a move necessitated by the need for more space than could be found in the present building at 119 West 57th Street.

Societies

The Western Ophthalmological Society will hold its Fourth Annual Meeting in Denver, Colorado, on July 22 and 23, 1937. This will immediately precede the Colorado Congress of Ophthalmology and the Denver Summer Postgraduate Course. An attractive program is being prepared under the leadership of Drs. Edward Jackson and William H. Crisp. Dr. Edwin M. Neher, of Salt Lake City, is this year's President. A detailed program will be announced later.

The Washington, D.C. Ophthalmological Society will meet on Monday, May 31st at the auditorium of the Medical Society of the District of Columbia. This will be a joint meeting with the members of the Postgraduate course in Ophthalmology to be given by the Department of Ophthalmology of the George Washington University School of Medicine.

The program will be a symposium on cataract, with Drs. Clyde A. Clapp, Conrad Berens, and Edmund B. Spaeth as the guest speakers of the evening.

Members of the Eye Section of The Philadelphia County Medical Society and the Eye Section of the College of Physicians met April 12, 1937, at 4 P.M. in a special joint meeting to consider: (1) Ways and means of best combating ill-advised legislation in the State of Pennsylvania adverse to the public welfare and inimical to the ideas of ophthalmologists; (2) The appointment or selection of committees or other agencies whose business it will be to study, advise, and coördinate appropriate activities and to coöperate with the State Society.

The Eye Section of the Philadelphia County Medical Society met Thursday evening, April 1, 1937. The following program was presented: The coöperative study and treatment of glaucoma of dispensary patients with the purpose of reducing the incidence of blindness, by Dr. Mark J. Schoenberg (New York); Discussed by Dr. Francis Heed Adler and Dr. Charles E. G. Shannon. The National Society for the Prevention of Blindness, by Dr. B. Franklin Royer.

Personals

Dr. H. Arruga of Barcelona, Spain, was lately in this country after an extended tour which included Rio de Janeiro, São Paulo, Buenos Aires, Cordova, and Montevideo. He then went to Puerto Rico and Venezuela. In all these places he gave practical demonstrations of his methods of operating on detachment of the retina, cataract by the intracapsular method, and dacryocystorhinostomy. In Buenos Aires and Brazil he gave some lectures on the same subject and in the former city was the guest of honor at a special meeting of the Buenos Aires Ophthalmological Society. In New York he attended the Section of Ophthalmology of the Academy of Medicine and operated in many of the leading hospitals. He also visited Chicago, Philadelphia, and Harrisburg. He left for Europe on the 19th of March.

Dr. Don Marshall, Assistant Professor of Ophthalmology at the University of Michigan, has been appointed to the position of Director of the Department of Ophthalmology of the George F. Geisinger Memorial Hospital, Danville, Pennsylvania.

Mr. John Fleming of London, England, died of pneumonia at his home on Thursday, March 25th. Mr. Fleming, together with his brother, Robert Fleming, founded the wholesale optical house of J. and R. Fleming, Ltd. Mr. Fleming devoted his life to the optical field and became one of the best known and most respected leaders in optical circles, in all Europe.